



Mark Scheme (Results)

Summer 2019

Pearson Edexcel GCSE
In Biology (1BI0) Paper 1H

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		Command Word	
Strand	Element	Describe	Explain
AO1		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

Question number	Answer	Mark
1(a)(i)	<p>C solution Y</p> <p>1ai. The only correct answer is C</p> <p><i>A is not correct because the solution does not contain starch and contains protein</i></p> <p><i>B is not correct because the solution contains protein</i></p> <p><i>D is not correct because the solution does not contain starch</i></p>	<p>(1)</p> <p>AO3(1a)</p>

Question number	Answer	Additional Guidance	Mark
1(a)(ii)	<p>An answer including:</p> <ul style="list-style-type: none"> • add Benedict's (reagent) (1) • heat the solution / the solution turns (brick) red (1) 	<p>accept use a water bath</p> <p>accept colour in the range from green-yellow- orange to red</p>	<p>(2)</p> <p>AO1 (2)</p>

Question number	Answer	Additional Guidance	Mark
1(b)	<p>An answer including:</p> <ul style="list-style-type: none"> • measure the start and end temperature (of the water) (1) • burn the food (in the chamber) (1) • use the increase in the temperature of water to calculate the energy content (1) 	<p>accept use the thermometer to measure the (water) temperature</p> <p>ignore heat the food</p> <p>accept use temperature change to calculate the energy content</p> <p>ignore the temperature rise is the energy content</p>	<p>(3)</p> <p>AO1 (2)</p>

(total for question 1 = 6 marks)

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

Question number	Answer	Additional Guidance	Mark
2(b)(i)	to precipitate the DNA	accept so the DNA is visible / so the DNA is not soluble (in ethanol)	(1) AO1 (2)

Question number	Answer	Additional Guidance	Mark
2(b)(ii)	Any two from: <ul style="list-style-type: none"> • mass of fruit (1) • volume of buffer (1) • crushing method /crushing time / crushed evenly (1) • volume of ethanol (1) • temperature (1) • pH /same buffer solution (1) 	accept amount of fruit / number of fruit cells /size of fruit ignore amount of buffer accept idea of incubation time ignore amount of ethanol accept fully filtered (1) accept same concentration of ethanol (1)	(2) A02 (2)

Question number	Answer	Additional Guidance	Mark
2(b)(iii)	<p>Any one from:</p> <ul style="list-style-type: none"> to obtain more data (1) to identify anomalies (1) see if the results are {the same /reliable/correct} (1) to calculate a {mean/average} (1) 	<p>accept to be sure their {results are valid / conclusion is valid} (1)</p> <p>ignore accuracy/precision</p>	<p>(1)</p> <p>AO2(2)</p>

Question number	Answer	Additional Guidance	Mark
2(c)	<p>Any three from:</p> <ul style="list-style-type: none"> mitosis produces 2 cells and meiosis produces 4 cells (1) mitosis produces genetically identical cells and meiosis produces genetically different cells (1) mitosis produces diploid cells and meiosis produces haploid cells (1) mitosis produces body cells and meiosis produces {gametes /sex cells} (1) 	<p>accept offspring for cells</p> <p>mitosis is involved in asexual reproduction and meiosis is involved in sexual reproduction (1)</p>	<p>(3)</p> <p>AO1 1</p>

(Total for question 2 = 9 marks)

Question number	Answer	Additional Guidance	Mark
3(a)	<p>An explanation linking three of the following:</p> <ul style="list-style-type: none"> • they are immune (to <i>Clostridium tetani</i>) (1) • because the vaccination contained an antigen / bacteria have antigens (1) • memory lymphocytes (1) • leading to the production of antibodies (1) • leading to a secondary (immune) response (1) 	<p>accept idea of inactive/dead bacteria in the vaccine</p> <p>accept bacteria killed {faster/quicker/quickly}</p>	<p>(3)</p> <p>AO2(1)</p>

Question number	Answer	Additional guidance	Mark
3(b)	<p>An explanation linking four of the following:</p> <ul style="list-style-type: none"> • people do not finish their course (of Colistin) (1) • natural selection /evolution (occurs) (1) • some bacteria have a mutation/ (genetic) variation (1) • (these) resistant bacteria survive /resistant bacteria reproduce (1) 	<p>accept overuse / repeated exposure (to the antibiotic)</p> <p>accept they have evolved</p> <p>accept some bacteria have a {gene/allele} for resistance</p> <p>accept the non-resistant bacteria die</p>	<p>(4)</p> <p>AO2 1</p>

		/ the fittest bacteria survive ignore immune bacteria	
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(Total for question 3 = 7 marks)

Question number	Answer	Additional guidance	Mark
4(a)(i)	$(292 + 301 + 297) = 890$ (1) $(890 \div 3) 296.7$ (1) given to 3 s.f. (1) 297	full marks for correct answer with no working ecf from mp1 allow 296.67 or answers correct to any number of decimal places for 2 marks including the dot to show recurring numbers. ecf from mp2 accept 296 for 2 marks award 1 mark for 296.6/ 296.66	(3) AO2

Question number	Answer	Additional guidance	Mark
4(a)(ii)	Any one from: <ul style="list-style-type: none"> as age increases focusing distance increases /ORA (1) as age increases people {become more long-sighted / cannot see objects close up clearly} / ORA (1) different people of the same age have different focusing distances (1) 	accept a conclusion that links age group to a focus distance ignore cannot see objects in the distance	(1) AO3 2a

Question number	Answer	Additional guidance	Mark
4(a)(iii)	<p>Any two from:</p> <ul style="list-style-type: none"> • use more people /repeat the test (with more people) (1) • use more ages (1) • repeat the test for each person (1) • controlling a variable in the people selected (1) • reference to no other eye defect / health issues (1) • controlling {external environment / test used} (1) 	<p>accept named variable e.g. sex</p> <p>ignore defects in distance vision</p> <p>accept named factors e.g. light levels / same book / same font</p>	<p>(2)</p> <p>AO3/3b</p>

Question number	Answer	Mark
4(b)	<p>C cones</p> <p>4b. The only correct answer is C</p> <p><i>A is not correct because the iris controls the size of the pupil</i></p> <p><i>B is not correct because the lens focuses the light rays onto the retina</i></p> <p><i>D is not correct because the cornea refracts light</i></p>	<p>(1)</p> <p>AO1 (1)</p>

Question number	Answer	Additional guidance	Mark
4(c)(i)	<p>An answer including:</p> <ul style="list-style-type: none"> light rays {refracted / bent} {at the cornea /by the lens} (1) (light rays) {converge / focus} on the retina / focal point is on the retina (1) 	<p>reject for references to light going through/refracted by the iris</p> <p>accept (refracted) onto the retina</p> <p>accept rods / cones for retina</p> <p>ignore back of the eye/optic nerve</p>	<p>(2)</p> <p>AO1</p>

Question number	Answer	Additional guidance	Mark
4(c)(ii)	<p>An explanation linking two from:</p> <ul style="list-style-type: none"> lens X which is a {diverging/concave lens} (1) {lens X/a diverging lens/a concave lens} will {diverge/spread} out the light rays (1) 	<p>accept a {concave /diverging} lens</p> <p>reject lens Y</p>	<p>(2)</p> <p>Exp</p> <p>AO2</p>

(Total for Question 4 = 11 marks)

Question number	Answer	Mark
5(a)(i)	<p>A Eukarya</p> <p>5ai. The only correct answer is A</p> <p><i>B is not correct because plants are not single celled prokaryotic organisms</i></p> <p><i>C is not correct because plants are not single celled prokaryotic organisms and Monera is a kingdom</i></p> <p><i>D is not correct because Protista is a kingdom and not a domain</i></p>	<p>(1)</p> <p>comp</p> <p>AO1 (1)</p> <p>4.7, 1.1</p>

Question number	Answer	Mark
5(a)(ii)	<p>A oxygen produced sunlight absorbed by chlorophyll</p> <p>5a(ii). The only correct answer is A</p> <p><i>B is not correct because photosynthesis doesn't produce carbon dioxide and sunlight is not absorbed by mitochondria</i></p> <p><i>C is not correct because sunlight is absorbed by chlorophyll not mitochondria</i></p> <p><i>D is not correct because photosynthesis doesn't produce carbon dioxide it produces oxygen</i></p>	<p>(1)</p> <p>AO1 (1)</p>

Question number	Answer	Mark
5(a)(iii)	Any one from: <ul style="list-style-type: none"> • (improved) genetic analysis (1) • DNA/RNA {screening/sequencing} (1) • domain theory is based on genetics (1) • differences between coding and non-coding DNA (1) 	(1) AO1 (1)

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

Question number	Answer	Additional guidance	Mark
5(b)(ii)	<p>An answer including three of the following:</p> <ul style="list-style-type: none"> • no nucleus /chromosomal DNA (1) • cell wall (1) • flagellum (1) • presence of ribosomes (1) • no membrane bound organelles / no mitochondria (1) 	<p>List rule applies: reject nucleus reject mitochondria</p> <p>accept DNA is in the cytoplasm</p> <p>accept: pili (1) slime {coat / capsule / layer}(1)</p> <p>ignore: cell membrane / cytoplasm / chloroplast</p>	<p>(3) exp AO1 (1)</p>

Question number	Answer	Additional guidance	Mark
5(c)	<p>An explanation linking the following:</p> <ul style="list-style-type: none"> • cut the gene (from the genome) using restriction enzymes (1) • cut the plasmid with a restriction enzyme (1) • to leave {complementary / matching} sticky ends (1) • join the DNA using ligase (1) 	<p>accept endonucleases</p> <p>accept endonucleases</p> <p>accept the same sticky ends</p> <p>reject lipase</p>	<p>(3) AO1(1)</p>

(Total for question 5 = 12 marks)

Question number	Answer	Mark
6(a)(i)	<p>A 0.008 s^{-1}</p> <p>6ai/4ai. The only correct answer is A</p> <p><i>B is not correct because $1 \div 25$ is not a rate calculation</i></p> <p><i>C is not correct because $25 \div 120$ is not a rate calculation</i></p> <p><i>D is not correct because $120 \div 25$ is not a rate calculation</i></p>	(1) AO2(2)

Question number	Answer	Additional guidance	Mark
6(a)(ii)	<p>An explanation including:</p> <ul style="list-style-type: none"> increasing the {beads /enzyme/lactase} {decreases the time taken for glucose to be produced / increases the rate of reaction} (1) <p>and two of the following:</p> <ul style="list-style-type: none"> more beads increases the concentration of enzyme / more {enzyme / lactase} present (1) increased chance of collisions (1) with the active site (1) which means more enzyme-substrate complexes are formed (1) 	<p>accept reverse argument</p> <p>increasing the amount of lactase/enzyme {decreased the time for glucose to be produced/increases the rate of reaction} is worth 2 marks</p>	(3) AO3 2a+2b

Question number	Answer	Additional guidance	Mark
6(a)(iii)	<p>An explanation linking the following:</p> <ul style="list-style-type: none"> • lactose is the substrate (1) • to control a variable / it is a controlled variable (1) • allow results to be compared (1) • to allow a valid conclusion to be drawn /to make the experiment valid /to make the results valid (1) 	<p>ignore it is a control accept so that only enzyme (concentration) affects the reaction</p> <p>ignore: references to fair test / accurate / reliable results</p>	<p>(2)</p> <p>AO2(2)</p>

Question number	Answer	Additional Guidance	Mark
6(b)	<p>An answer that combines the following points to provide a plan:</p> <ul style="list-style-type: none"> • Mix equal {number of beads/volume of lactase} with equal volume of lactose (1) • (incubate the tubes) at different temperatures (1) • test for (the presence of) glucose (at regular intervals) / time how long it takes to produce glucose (1) 	<p>accept heat for temperature</p> <p>accept the temperature that produces glucose quickest is the optimum</p>	<p>(3)</p> <p>AO3 3b</p>

(Total for question 6 = 9 marks)

Question number	Answer	Additional Guidance	Mark
7(a)	<p>An answer including:</p> <ul style="list-style-type: none"> the viruses use host cell machinery (1) {viral genetic material / viral proteins} are made by the cell (1) new virus particles assemble (1) lyse host cells (to release viral particles) (1) 	<p>accept the virus takes over the cell</p> <p>accept DNA/RNA for genetic material</p> <p>accept new viruses are produced (inside the cell)</p> <p>accept bursts cell/destroys cell/disrupt cell membrane if linked to the idea of release</p>	<p>(3)</p> <p>AO1</p>

Question number	Answer	Additional Guidance	Mark
7(b)(i)	cortex /cerebral {hemisphere/cortex} / cerebrum	<p>accept parietal lobe</p> <p>reject cerebellum</p>	<p>(1)</p> <p>AO1(1)</p>

Question number	Answer	Additional Guidance	Mark
7(b)(ii)	$0.15 \div 100 = 0.0015$ (1) $134\,250 \div 0.0015 = 89\,500\,000$ (1) 8.95×10^7 or 9.0×10^7 OR $134\,250 \div 0.15 = 895\,000$ (1) $895\,000 \times 100 = 89\,500\,000$ (1) 8.95×10^7 or 9.0×10^7 OR $100 \div 0.15 = 666.67$ (1) $666.67 \times 134\,250 = 89\,500\,000$ (1) 8.95×10^7 or 9.0×10^7	award full marks for correct answer accept 8.9×10^7 / accept 89.5×10^6 / 89 500 000 for 2 marks accept 8.95×10^5 or 9.0×10^5 for 2 marks	(3) AO2(1)

Question number	Answer	Additional Guidance	Mark
7(c)(i)	<p>An answer including two of the following:</p> <ul style="list-style-type: none"> • concerns over side effects of immunisation / concerns over the risk of allergic reactions (1) • medical reason for not being immunised (1) • too young for the vaccination programme (1) • no access to healthcare (1) 	<p>accept named religious objections</p> <p>accept not in the country for the vaccination as a child</p> <p>they have already had measles (1)</p> <p>scared of needles (1)</p> <p>ignore didn't get a vaccine</p>	<p>(2)</p> <p>AO2(1)</p>

Question number	Answer	Additional Guidance	Mark
7(c)(ii)	<p>An answering including:</p> <ul style="list-style-type: none"> • most people are immunised / high level of immunity in the population (1) • so non-immunised people are protected from measles infection as they are {less likely to come into contact with the pathogen/someone with measles/measles is less likely to spread through the population} (1) 	<p>reject it means non-vaccinated people are immune</p> <p>accept disease/pathogen/infection for measles</p>	<p>(2)</p> <p>AO1(1)</p>

(Total for question 7 = 11 marks)

Question number	Answer	Additional Guidance	Mark
8(a)(i)	<p>An answer including:</p> <ul style="list-style-type: none"> (statins) reduce the level of LDL cholesterol (1) by 1.4 mmol per dm³ / from 3.8 mmol per dm³ to 2.4 mmol per dm³ 	<p>accept LDL cholesterol decreases</p> <p>accept idea that it decreases from 3.8 mmol per dm³ to a lowest value of 2.3 mmol per dm³</p> <p>accept 1.5 mmol per dm³</p>	<p>(2)</p> <p>AO3 (1a+1b)</p>

Question number	Answer	Mark
8(a)(ii)	<p>An explanation linking the following:</p> <ul style="list-style-type: none"> level of LDL increases after the medication is stopped (1) increases risk of {heart disease/heart attack/stroke/cardiovascular diseases/high blood pressure} (1) 	<p>(2)</p> <p>AO3 2a+2b</p>

Question number	Answer	Mark
8(b)	<p>C mass and height</p> <p>8b. The only correct answer is C</p> <p><i>A is not correct because waist circumference is not used to calculate BMI</i></p> <p><i>B is not correct because neither waist circumference nor hip circumference are used to calculate BMI</i></p> <p><i>D is not correct because hip circumference is not used to calculate BMI</i></p>	<p>(1)</p> <p>AO1(1)</p>

Question number	Indicative content		Mark
*8(c)	<p>AO2</p> <ul style="list-style-type: none"> • gonorrhoea is spread by exchange of bodily fluids / sexual contact • from mother to child during childbirth • barrier contraception methods/condoms will reduce spread • abstinence prevents infection • screening for infections • contact tracing partners of infected individuals • education on the disease and ways to reduce its spread • treating infections with antibiotics <p>AO3</p> <ul style="list-style-type: none"> • number of cases in males higher than females • number of cases in males has increased since 2008 • number of cases in males has increased rapidly since 2010 • number of cases in females has increased since 2010 • rate of increases in cases is higher in men than women • comparative manipulation of data 		(6) AO3/AO2
Level	Mark	Descriptor	
	0	No rewardable material.	
Level 1	1-2	<ul style="list-style-type: none"> • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information attempted but will be limited with focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) 	
Level 2	3-4	<ul style="list-style-type: none"> • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) 	
Level 3	5-6	<ul style="list-style-type: none"> • The explanation is supported through linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) • Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) 	

Level	Mark	Additional Guidance	General additional guidance – the decision within levels
	0	No rewardable material.	The explanation of how Gonorrhoea is transmitted and infection rates reduced drives the level choice. The graph references decide the mark within the band
Level 1	1–2	<ul style="list-style-type: none"> A simple explanation that includes one aspect from the mechanism of spread, ways in which gonorrhoea can be prevented or how the number of people infected can be reduced by treatment (AO2) A simple trend from the data (AO3) 	<p><u>Possible candidate responses</u></p> <ul style="list-style-type: none"> Gonorrhoea is spread by sexual contact/the exchange of body fluids The spread of gonorrhoea can be prevented by using a condom/barrier contraception/abstinence The number of people diagnosed with gonorrhoea has increased More men are diagnosed with gonorrhoea than women The number of cases in men and women are both rising The number of cases in males is rising faster than the number of cases in females.
Level 2	3–4	<ul style="list-style-type: none"> An explanation that includes at least two aspects from the mechanism of spread, ways in which gonorrhoea infection can be prevented or how the number of people infected can be reduced by treatment (AO2) The explanation makes reference to at least one trend in the graph including numerical values of relevant years or numbers of people diagnosed (AO3) 	<p><u>Possible candidate responses</u></p> <ul style="list-style-type: none"> Gonorrhoea is spread by sexual contact/the exchange of body fluids and it's spread can be prevented by using a condom/barrier contraception/abstinence. The number of cases in males has increased since 2008 and rapidly since 2010 Gonorrhoea is spread by sexual contact/the exchange of body fluids and because it is a bacterial infection it can be treated with antibiotics. The number of people diagnosed is increasing, for women 5000 people were diagnosed in 2010 and 8000 in 2014 Gonorrhoea is spread by sexual contact and educating people about the disease and the use of condoms will prevent it spreading. The number of cases diagnosed is increasing. In 2014 26000 men were diagnosed and 8000 women
Level 3	5–6	<ul style="list-style-type: none"> A detailed explanation that includes aspects from the mechanism of spread, ways in which gonorrhoea can be prevented and how the number of people infected can be reduced by treatment with antibiotics (AO2) The explanation makes a comparison between data in the graph including either the difference in infection rates between men and women or indicates the rise in the numbers of people diagnosed (AO3) 	<p><u>Possible candidate responses</u></p> <ul style="list-style-type: none"> Gonorrhoea is spread by sexual contact/the exchange of body fluids and it's spread can be prevented by using a condom/barrier contraception/abstinence. It is a bacterial infection, so it can be treated with antibiotics. The number of people diagnosed is increasing for men and women. For example, the number of cases in males has increased from 2008 to 2014 by 16 000. Gonorrhoea is spread by sexual contact/the exchange of body fluids and educating people about the disease and the use of condoms will prevent it spreading. It is treated with antibiotics, but antibiotic resistance is becoming a problem. The number of people diagnosed is increasing for men and women. More men are diagnosed each year than women, for example, in 2014 8000 women were diagnosed and 26 000 men were diagnosed.

(Total for question 8 = 11 marks)

Question number	Answer	Mark
9(a)(i)	<p>C RNA polymerase</p> <p>9ai. The only correct answer is C</p> <p><i>A is not correct because ligase is used to join DNA molecules together</i></p> <p><i>B is not correct because lysozyme is a chemical defence for the body</i></p> <p><i>D is not correct because restriction endonucleases cut DNA molecules</i></p>	<p>(1)</p> <p>AO1(1)</p>

Question number	Answer	Additional guidance	
9(a)(ii)	<p>An answer including:</p> <ul style="list-style-type: none"> • {prevents/reduces} binding of RNA polymerase (to non-coding DNA) (1) • meaning that mRNA can not be produced/less mRNA is produced (1) 	<p>accept RNA polymerase produces a mRNA strand.</p> <p>ignore prevents transcription</p>	<p>(2)</p> <p>AO1(1)</p>

Question number	Answer		Mark
9(b)	<p>An explanation linking three of the following:</p> <ul style="list-style-type: none"> • 7th base is C-G mutation / changes the (codon) from CAG to GAG (1) • changes the amino acid from Gln to Glu (1) • sequence of the amino acids is different (1) • protein folds differently/active site is a different shape (which affects protein function) (1) 	<p>accept the C is now a G/ third codon is now GAG</p> <p>accept the polypeptide sequence is different</p> <p>accept {protein/polypeptide} has a different shape</p>	<p>(3)</p> <p>AO3</p> <p>2a+2b</p>

Question number	Indicative content	Mark									
9(c)	<p>AO2</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>I^B</td> <td>I^o</td> </tr> <tr> <td>I^A</td> <td>I^A I^B</td> <td>I^A I^o</td> </tr> <tr> <td>I^o</td> <td>I^o I^B</td> <td>I^o I^o</td> </tr> </table> <p>Indicative content</p> <ul style="list-style-type: none"> • I^o is recessive to I^A or I^B • mothers genotype must be I^AI^o • fathers genotype must be I^BI^o • child must inherit two recessive I^o alleles • child genotype of I^oI^o • offspring have 25% chance of being blood group O 		I ^B	I ^o	I ^A	I ^A I ^B	I ^A I ^o	I ^o	I ^o I ^B	I ^o I ^o	<p>(6)</p> <p>AO2(1)</p>
	I ^B	I ^o									
I ^A	I ^A I ^B	I ^A I ^o									
I ^o	I ^o I ^B	I ^o I ^o									

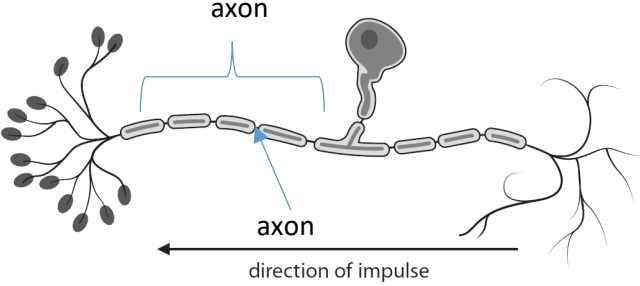
Level	Mark	Descriptor
	0	<ul style="list-style-type: none"> No awardable content
Level 1	1-2	<ul style="list-style-type: none"> The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3-4	<ul style="list-style-type: none"> The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5-6	<ul style="list-style-type: none"> The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels
	0	No rewardable material.	The explanation of how the child is blood group O drives the level choice. The accuracy of the use of the genetic terms decides the mark within the band.
Level 1	1–2	<ul style="list-style-type: none"> The simple explanation includes at least one area of content from a correct Punnett square, an indication of parental genotype, the rules of blood group inheritance or probability. The lines of reasoning use minimal genetic terms accurately (A02) 	<u>Possible candidate responses</u> <ul style="list-style-type: none"> A correctly completed Punnett square without the parents labelled but an indication that the probability of the child being blood group O is 25% The child received two copies of the I^o allele Blood group A and blood group B are dominant to blood group O. The parental genotypes and an explanation that refers to them being carriers of the blood group O.
Level 2	3–4	<ul style="list-style-type: none"> The explanation includes at least three areas of content from a correct Punnett square, an indication of parental genotype, the rules of blood group inheritance or probability. The lines of reasoning use some genetic terms including dominant, recessive, allele, genotype and blood group correctly (A02) 	<u>Possible candidate responses</u> <ul style="list-style-type: none"> A correctly completed Punnett square with the parental genotypes labelled and indication that the probability of the child being blood group O is 25% The child received two copies of the I^o allele and the allele for blood group O is recessive. The alleles for blood group A and blood group B are codominant. The parental genotypes and an explanation that refers to them being carriers of the allele for blood group O which can be passed onto the child who receives two copies of the recessive allele
Level 3	5–6	<ul style="list-style-type: none"> The detailed explanation includes a correct Punnett square, an indication of parental genotype, the rules of blood group inheritance and probability. The lines of reasoning use genetic terms including dominant, recessive, allele, genotype and blood group correctly (A02) 	<u>Possible candidate responses</u> <ul style="list-style-type: none"> A correctly completed Punnett square with the parental genotypes labelled and indication that the probability of the child being blood group O is 25% because they inherit one recessive I^o allele from each parent and the I^A allele and I^B allele are dominant to I^o allele A correctly completed Punnett square with the parental genotypes labelled and indication that the probability of the child being blood group O is 25% because they inherit one recessive I^o allele from each parent and blood group A and blood group B are dominant to blood group O.

(Question 9 = 12 marks)

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

Question number	Answer	Additional guidance	Mark
10(a)(ii)	An explanation linking: <ul style="list-style-type: none"> • (myelination) speeds up impulses (1) • insulates the {axon/neurone} (1) • motor neurones transmit information from the CNS / motor neurones transmit information to effectors / neurones in the brain connect to other neurones in the brain (1) • (motor neurones) transmit information over a greater distance (than neurones in the brain) (1) 	accept signals/messages for impulses accept brain/spinal cord/relay neurone for CNS accept muscles/ glands for effectors accept idea that motor neurones can be part of a reflex so need quick impulses (1)	(3) AO2(1)

Question number	Answer	Mark
10(b)(i)	 <p data-bbox="395 763 1062 844">accept label line to any part of axon as indicated ignore lines to the myelin sheath</p>	(1) AO1(1)

Question number	Answer	Additional Guidance	Mark
10(b)(ii)	<p data-bbox="395 1055 691 1093">An answer including:</p> <ul data-bbox="395 1122 943 1435" style="list-style-type: none"> <li data-bbox="395 1122 887 1160">• transmit electrical impulses (1) <li data-bbox="395 1279 943 1435">• from {receptors / sense organ / named sense organ} to the {CNS /brain / spinal cord / relay neurone} (1) 	<p data-bbox="1002 1122 1209 1240">accept signals/ messages for impulses</p> <p data-bbox="1002 1270 1201 1420">accept named receptors ignore detect stimuli</p>	(2) AO1(1)

Question number	Answer	Additional guidance	Mark
10(c)	<p>An explanation linking the following:</p> <ul style="list-style-type: none"> • synapse is a gap between neurones (1) • (electrical) impulse stimulates the release of chemical (1) • neurotransmitter (1) • (chemical/neurotransmitter) diffuses across the {gap/synapse} (1) • stimulates an (electrical) impulse in the next neurone (1) 	<p>accept by neurotransmission (1)</p>	<p>(4)</p> <p>AO1(1)</p>

(Total for question 10 = 12 marks)

