

Pearson
Edexcel

Mark Scheme (Results)

November 2021

Pearson Edexcel GCE
In Biology B (9BI0/01)
Paper 1: Advanced Biochemistry, Microbiology and Genetics

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Question Number	Answer	Additional Guidance	Mark
1(a)	An explanation that makes reference to two of the following: • because DNA needs to be {amplified / replicated} (1) • as only small samples are taken / to produce enough DNA (1) • all copies of the DNA need to be identical (to the original sample) (1)		(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to two of the following: • because of the {differences in / hypervariable regions} (in each individual's DNA) (1) • so produce fragments of different lengths (1) **OR** • different {fragments / lengths} of DNA are separated out (1)	**ACCEPT** unique DNA **ACCEPT** each individual has different abundance of different sized DNA (fragments) **OR** **ACCEPT** fragments therefore move through gel at different rates / smaller fragments move {further / faster} / converse for larger	(2)

Question Number	Answer	Additional Guidance	Mark
1(c)	**The only correct answer is B** **A** is incorrect because child 2 has no matching bands with the father **C** is incorrect because child 2 has no matching bands with the father **D** is incorrect because child 4 has no matching bands with either adult		(1)

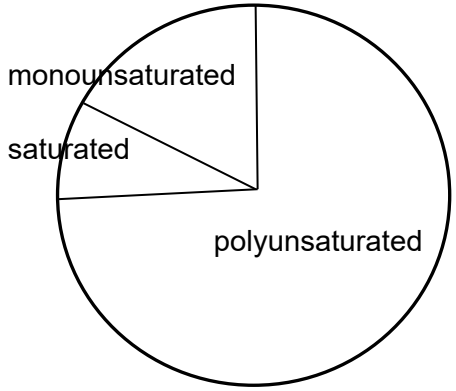
Question Number	Answer	Additional Guidance	Mark
2(a)(i)	• glucose is a monosaccharide and maltose is {a disaccharide / made of two glucoses / made of two monosaccharides} (1)	**ACCEPT** maltose has a glycosidic bond and glucose does not glucose has 6 carbons and maltose has 12 glucose has the formula $C_6H_{12}O_6$ and maltose $C_{12}H_{22}O_{11}$ **ACCEPT** a labelled diagram	(1)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An explanation that makes reference to two of the following: • neither sugars respired immediately because the yeast need to {acclimatise / adjust to the conditions} (1) • delay is longer for maltose as {enzymes need to be synthesised / maltose needs to be broken down into glucose} (1) • respiration of maltose is faster (than glucose) as maltose has {twice the number of sugar units / more glucoses / more hydrogens} (1)	**ACCEPT** glycosidic bonds have to be broken **ACCEPT** because maltose contains more energy / maltose is a disaccharide and glucose is a monosaccharide	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)	An explanation that makes reference to the following: • lactose is not {respired / used} as the yeast do not produce {the appropriate enzymes / lactase} (1) • sugars in the cytoplasm are {used / respired} (1)	**ACCEPT** yeast cannot break lactose down **NB** at least one reference to respiration for both marks to be awarded	(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• an O drawn between the two covalent bonds		(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	**The only correct answer is A** **B** is incorrect because three water molecules (54) have to be subtracted, not one **C** is incorrect because three water molecules 54 have to be subtracted, not six hydrogens **D** is incorrect because three water molecules 54 have to be subtracted		(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• pie chart drawn showing lipid content of safflower oil, labelled	 saturated section less than monounsaturated and polyunsaturated three quarters by eye	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	• percentage of polyunsaturated lipids in 500 g {beef / oil} calculated (1) • 355 (g) (1)	Example of calculation: (3 + 1) × (500 ÷ 100) = 20 75 × (500 ÷ 100) = 375 Correct answer with no working gains full marks	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	An explanation that makes reference to the following: • because plant products will contain less {cholesterol / saturated lipids} (than animal products) (1) • therefore there will be less cholesterol (in the blood stream) to {build up / form a plaque / form an atheroma} in an artery (1)	**ACCEPT** converse explanation **ACCEPT** more polyunsaturated lipids	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)	An explanation that makes reference to two of the following: • the phosphate (head) is {polar / hydrophilic} (1) • therefore the phosphate can interact with the aqueous environment (1) • otherwise the lipids {will form a micelle / will not form a bilayer (and not enclose the cytoplasm) (1)	**ACCEPT** dissolve in water in the cytoplasm and environment	(2)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><th rowspan="2">Molecule</th><th colspan="4">Mineral ions used</th></tr>
<tr><th>nitrate ions only</th><th>phosphate ions only</th><th>both nitrate and phosphate ions</th><th>neither nitrate nor phosphate ions</th></tr>
<tr><td>amino acid</td><td>X</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>DNA</td><td>☐</td><td>☐</td><td>X</td><td>☐</td></tr>
</table>
</td><td></td><td>(2)</td></tr>
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Question Number	Answer	Additional Guidance	Mark
4(b)(i)	**The only correct answer is C** **A** is incorrect because 31 460 would be rounded up to 3.15×10^4 **B** is incorrect because 314 600 would be rounded up to 3.15×10^5 **D** is incorrect because 3 139 000 would be rounded up to 3.14×10^6		(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	**The only correct answer is C** **A** is incorrect because symplast pathway does not go through cell walls **B** is incorrect because it shows the pathways the wrong way round **D** is incorrect because it shows apoplastic going through the cytoplasm		(1)

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	**The only correct answer is B** *A is incorrect because water moves from a dilute solution to a more concentrated one* ***B** is incorrect because water moves from a high water potential to a lower one* ***D** is incorrect because water moves from a high water potential to a lower one*		(1)

Question Number	Answer	Additional Guidance	Mark
4(c)	An explanation that makes reference to the three of the following: • water has a (small) positively charged {hydrogen / end} and a (small) negatively charged {oxygen / end} (1) • therefore hydrogen bonds form (between water molecules) (1) • therefore water moved due to {cohesion / cohesive forces} (between water molecules) (1) • (because of) {adhesion / adhesive forces} between water and xylem (1)	**ACCEPT** cohesive properties **ACCEPT** adhesive properties water moves due to adhesive and cohesive forces = 1 mark if no other mark awarded	(3)

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	An answer that makes reference to the following: • composed of protein and RNA (1) • (arranged in) two {(sub) units / parts} (1)	**ACCEPT** large and small subunit / 60S and 40S subunit / 50S and 30S subunit	(2)

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	An answer that makes reference to two of the following: • translation (1) • to hold the tRNA on the mRNA (1) • whilst peptide bonds form to join (adjacent) amino acids together (1)		(2)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	• {fewer / smaller} cristae / less folding of the inner membrane / reduced surface area of inner membrane		(1)

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	An explanation that makes reference to two of the following: • (fewer cristae / lower surface area) therefore reduced electron transport chain (1) • because ribosomes prevented from synthesising {enzymes / ATPase / electron transport molecules} (1) • credit reason linked to protein not made (1)	e.g. no enzymes to catalyse steps in Krebs cycle, no ATPase channels for {protons to pass through / phosphorylation of ADP}, no ETC so no redox reactions **ACCEPT** less intermembrane space for accumulation of protons = 1 mark	(2)

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	An explanation that makes reference to the following: • no ATP will be produced (if both inhibited / glycolysis inhibited) (1) • therefore no {energy / ATP} for metabolic process / named metabolic processes / cell division} (1)		(2)

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	An explanation that makes reference to three of the following: • each pigment will absorb different wavelengths (of light) (1) • each pigment will absorb different amounts of light at each wavelength (1) • action spectrum is different because the seaweeds are absorbing different wavelengths of light (1) • the rate of photosynthesis will therefore be different at each wavelength(1)	**ACCEPT** each pigment will reflect different wavelength (of light) description of which colour light is {reflected / absorbed}	(3)

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	An explanation that makes reference to three of the following: • green seaweeds found in shallow water as they {cannot absorb the green light / can absorb the red light} (1) • {brown / red} seaweeds can absorb {green / blue / other} wavelengths of light so are positioned further down as these wavelengths can penetrate further (1) • seaweeds positioned so that they can absorb light for {photosynthesis / light-dependent reactions / photolysis} (1) • seaweeds positioned to avoid competition with the other types of seaweed (1)	**ALLOW** plants for seaweeds	(3)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	• 2.0 / 1.9 / 1.93 (times / ×)	**DO NOT ACCEPT** 1.93 recurring	(1)

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	An explanation that makes reference to three of the following: • water is more effective than culture media for washing (1) • {water is not the solvent / ethanol is the solvent} for fucoxanthin (1) • ethanol {increases permeability of / disrupts} (cell / vacuole) membrane (1) • more fucoxanthin extracted in method A (compared with method B) because water enters the seaweed {by osmosis / causing the cells to burst} (1)	**ACCEPT** more fucoxanthin extracted in A because washed with water	(3)

Question Number	Answer	**Additional Guidance**	Mark
7(a)(i)	**The only correct answer is B** ***A** is incorrect because tetracycline targets the ribosomes* ***C** is incorrect because tetracycline targets the ribosomes and penicillin targets the cell wall* ***D** is incorrect because penicillin targets the cell wall*		(1)

Question Number	Answer	**Additional Guidance**	Mark
7(a)(ii)	**The only correct answer is B** ***A** is incorrect because tetracycline is bacteriostatic* ***C** is incorrect because tetracycline is bacteriostatic and penicillin is bactericidal* ***D** is incorrect because penicillin is bactericidal*		(1)

Question Number	Answer	Additional Guidance	Mark
7(b)	An explanation that makes reference to the following: • antibiotics are only prescribed if the illness could be caused by bacteria / antibiotics not prescribed if the illness is caused by viruses only (1) • because antibiotics acts as a selection pressure for resistant bacteria (1)	**ACCEPT** reduces the {use of antibiotics / exposure of bacteria to antibiotics} **ACCEPT** a description e.g. presence of antibiotic wont be a selective advantage **DO NOT ACCEPT** immune	(2)

Question Number	Answer	Additional Guidance	Mark
7(c)(i)	• number of chicken and cattle with resistant *E.coli* (1) • ratio given (1) **OR** • mean percentage of resistant bacteria in chickens calculated (1) • ratio given (1)	Example of calculation: (43 + 25) 68 chickens and 3 cattle 22.67 : 1 / 22.7 : 1 / 23 : 1 / 1 : 0.04 (95.86 + 55.56) ÷ 2 = 75.71 (75.71 : 25.00 =) 3.03 : 1 / 3 : 1 **ACCEPT** 1 : 0.33 / 1 : 0.3 / 1 : 1 **NB** correct answer with no working gains two marks {6.06 : 1 / 6.1 : 1 / 6 : 1 / 1 : 0.17 / 1 : 0.2} = 1 mark	(2)

Question Number		Additional Guidance	Mark
7(c)(ii)	• mean number of resistant bacteria for cattle or rodents calculated (1) • answer (1)	Example of calculation: 8.33% of $2 \times 10^8 = 16.66 \times 10^6$ **OR** 14.58 % of $6 \times 10^9 = 87.48 \times 10^7$ 53 / 52.5 / 52.51 (times more) 8.6×10^8 / 8.58×10^8 / 858 140 000 etc (more bacteria) correct answer with no working gains two marks	(2)

Question Number	Answer	Additional Guidance	Mark
7(c)(iii)	An answer that makes reference to four of the following: • (idea supported because) overall there are more resistant bacteria in the animals reared for food (1) • (idea not entirely supported because) the bacteria in wild animals are more resistant to cephalothin (1) • the number of animals in each group is very small (1) • the number of different types of {animal / antibiotic} is limited (so data may not be representative) (1) • no standard deviations shown so spread of data is unknown (1)	**ACCEPT** other quoted data to illustrate exception **ACCEPT** validity of data	(4)

Question Number	Answer	Additional Guidance	Mark
8(a)	An answer that makes reference to the following: **Similarities** • both contain DNA (1) **Differences** • HPV is surrounded by {protein / capsid} and chlamydia by {a cell wall / peptidoglycan} (1) • HPV is hollow and chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipid droplets / plasmids} (1)	**ACCEPT** DNA strands in HPV **ACCEPT** chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipid droplets / plasmids} but HPV does not	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	An explanation that makes reference to the following: • vaccine contains the HPV antigens (1) • which stimulates the production of memory cells (1) • therefore (secondary) immune response destroys HPV before it causes cancer (1)	**ACCEPT** {attenuated / inactive / harmless / fragments of} {virus / pathogen **DO NOT ACCEPT** contains dead virus **ACCEPT** a description e.g. antibodies released faster so macrophages destroy HPV before it damages cells **DO NOT ACCEPT** antibodies destroy virus virus is killed	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	An explanation that makes reference to the following: • because the immune response is specific (1) • so on infection with Chlamydia there will not be memory cells present (specific to Chlamydia) (1) • and another (primary) immune response will need to be initiated (1) • therefore the Chlamydia will not be destroyed before it causes disease (1)	**ACCEPT** Chlamydia has different antigen to {HPV / the virus / the vaccine} **ACCEPT** no antibodies (against Chlamydia) present	(3)

Question Number	Indicative content	
***8(b)(iii)**	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content: Advantages of vaccinating girls and boys • protects students from becoming infected • virus less likely to get passed on • as there will be no virus to pass on during intercourse • because the virus will be destroyed before infections caused • the more girls vaccinated the fewer cases of cervical cancer and other conditions caused by HPV in girls • the more boys vaccinated the fewer cases of other conditions caused by HPV in boys because of {memory cells / active immunity} Advantages of vaccination in schools • more {boys / girls} likely to be vaccinated • because they are not reliant on a doctor's appointment being {made / available} • do not have to miss school for the appointment • seeing others being vaccinated might encourage others to get vaccinated • inoculating school children is likely to be before they become sexually active Points that can apply in either context (but only creditable once) • greater chance of developing herd immunity • therefore fewer infected people to pass virus onto uninfected people • help to protect those who cannot be infected	**Level 1** 1 mark = 1 comment 2 marks = 3 comments **Level 2 :** 3 marks = 4 comments 4 marks = 5 comments **Level 3** **NB** must include points on advantages of vaccinating boys **AND** vaccinating in school 5 marks = 5 comments 6 marks = 6 comments

Question Number	Answer	Additional Guidance	Mark
9(a)	An answer that makes reference to four of the following: • as the length of the dive increases and the depth of the dive increases, the percentage decreases (1) • appropriate conclusion about percentage and length of dive (1) • no information about how long the longest dive lasts (1) • appropriate conclusion about depth of dive (1) • no information on the length of time that dives at different depths last (1)	**NB** piece together **e.g.** most dives last less than 16 to 20 minutes some dives can last as long an hour **e.g.** most dives are up to 100 to 200 metres some dives may be as deep as 600 metres	(4)

Question Number	Answer		**Additional Guidance**	Mark
9(b)(i)	**The only correct answer is A** ***B** is incorrect because the haemoglobin would have a higher affinity for oxygen* ***C** is incorrect because the curve would be to the left* ***D** is incorrect because the curve would be to the left*			(1)

Question Number	Indicative content	
***9(b)(ii)**	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • less oxygen stored in seal's lungs • so that more is delivered to the body • reduces buoyancy • cannot be replenished as diving • lungs of seal must be able to diffuse oxygen into blood faster • therefore {larger surface area / faster blood flow} • blood of seal carries more oxygen • because their haemoglobin has a higher affinity for oxygen • blood of seal carries more oxygen because they release erythrocytes from the spleen • therefore can supply more oxygen to muscles for aerobic respiration • to release ATP for muscle contraction • muscles of seal have more myoglobin • therefore can store more oxygen until oxygen tensions are very low • so that aerobic respiration can take place • to release ATP for muscle contraction • anaerobic respiration would not supply enough ATP for muscle contraction • body fluids store the same level of oxygen • because they do not have a role in storing oxygen • small concentrations in body fluids, as oxygen is dissolved in it for diffusion into cells	**Level 1:** 1 mark = 1 comparison 2 marks = 3 comparisons **Level 2:** 3 marks = 1 set of data simply explained 4 marks = 2 sets of data simply explained **Level 3:** 5 marks = 3 sets of data explained with links to diving and muscles 6 marks = 4 sets of data explained with links to diving and muscles

Question Number	Answer	Additional Guidance	Mark
9(c)	An answer that makes reference to four of the following: • oxygen in blood decreases as it moves into {muscles / cells / named cell} for (aerobic) respiration (1) • blood retains some oxygen (even though the muscles are depleted) (1) • this is to supply oxygen to the brain so that the cells do not die (1) • oxygen decreases in muscles as it is used to generate ATP for muscle <u>contraction</u> (1)	**ACCEPT** energy	(3)

Question Number	Answer	Additional Guidance	Mark
9(d)	An explanation that makes reference to three of the following: • lactic acid (accumulation) in the muscles is toxic (1) • therefore it passes from the muscles into the blood (1) • lactic acid is taken from the muscles to the liver by the blood (1) • drop in pH (caused by lactic acid) will denature enzymes (in the cells / blood) (1)		(3)