Mark Scheme (Results)

Summer 2024

Pearson Edexcel Advanced Subsidiary GCE In Biology B (8BI0)
Paper 01: Core Cellular Biology and Microbiology

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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.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	**The only correct answer is** C **A** is incorrect because magnesium ions are not incorporated into amino acids or nucleotides **B** is incorrect because magnesium ions are not incorporated into amino acids **D** is incorrect because magnesium ions are not incorporated into nucleotides		(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	An explanation that makes reference to the following: • because water is {(di)polar } (solvent) (1) • ions form charged attractions / electrostatic attractions (with it) (1)	**ACCEPT** charged / hydrophilic **ACCEPT** form hydrogen bonds	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	An answer that makes reference to the following: • more nitrate ions are taken up in the presence of oxygen (1) • nitrate ions are taken up faster in the presence of oxygen (1) • Nitrates are taken up by (diffusion and) active transport in presence of oxygen/ nitrates only taken up by diffusion without oxygen present (1)	ACCEPT converse	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)	An answer that makes reference to the following: • three identical chromosomes at position 21 (1) • two **identical** chromosomes at positions 20, 22 and 23 (1)		(2)

Question Number	Answer	Additional Guidance	Mark
2(b)	• part of one chromosome drawn on the other chromosome (1)		(1)

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	An answer that makes reference to the following: • height in m^2 calculated (1) • BMI calculated (1)	(1.463 × 1.463 =) 2.140369 **Accept** rounding – 2.14, 2.1 21.1 (1) (=21.1178539) **Accept** (if rounded to 2.14) 21.1214953 **Accept** (if rounded to 2.1) 21.5238095/21.5 ECF for mp2 if height in cm^2 used Correct answer with no working gains 2 marks	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	An answer that makes reference to the following: • females with Turner's syndrome have (slightly) lower mass **and** height (1) • but error bars overlap, so may be no difference/more data is needed (1) • cannot tell if BMI is significantly different as there are no error bars (1) • sample size is quite small (in both groups) (1)		(4)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	**The only correct answer is A** **B** is incorrect because bacteria have 70S ribosomes **C** is incorrect because bacteria do not have a nucleus **D** is incorrect because bacteria do not have a nucleus or 80S ribosomes		(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	An answer that makes reference to the following: • cytoplasm • plasmids • cell membrane	3 correct = 2 marks 1 or 2 correct = 1 mark **ACCEPT** glycogen granules / lipid droplets /mesosome	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• 23 : 1.0	**Accept** 23 : 1 **Accept** 1.0 : 0.043 **Accept** 1 : 0.043	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	An explanation that makes reference to the following: • *B. subtilis*, because it {is Gram positive / has a thick peptidoglycan cell wall} (1) • antibiotics interfere with the synthesis of peptidoglycan (crosslinks) / inhibit formation of peptidoglycan (1)		(2)

Question Number	Answer	Additional Guidance	Mark
3(c)	An answer that makes reference to the following: • increase in cell number calculated (1) • rate calculated (1)	($1.7 \times 10^5 - 6 \times 10^3$ =) 164 000 1367 / 1366.7 / 1366.67 / 1366 recurring (cells per minute) 1366(.66) gains 1 mark Correct answer with no working gains 2 marks	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	**The only correct answer is C** **A** is incorrect because P is in prophase which comes before R which is in late anaphase **B** is incorrect because Q is in early anaphase which comes before R which is in late anaphase **D** is incorrect because S is in metaphase which comes before R which is in late anaphase		(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	An answer that makes reference to the following: • select the { anther / filament / carpel / ovary / embryo sac } (1) **and** any four from: • place in {acid / HCl} and {heat / place in hot / warm water bath} (1) • add acetic orcein (1) • tease the cells apart (with a mounted needle) / macerate (1) • place a coverslip on top and gently squash the preparation (1) • count total number of cells in each stage (of meiosis) / count (all) cells <u>and</u> count number of cells at metaphase I and metaphase II (1) • divide the number of cells in metaphase (multiplied by 100) by the total number of cells (1)	Sequence should be logical **Accept** stated temperature **Accept** other appropriate named stains e.g. Feulgen's, Toluene blue	(5)

Question Number	Answer	Additional Guidance	Mark
4(b)	An explanation that makes reference to the following: • independent assortment (1) • crossing over between homologous chromosomes (1) • different combinations of alleles (in the gametes) / different combinations of maternal and paternal chromosomes (1)		(3)

Question Number	Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following: **A** : matrix (space) **B** : outer membrane / envelope **C** : crista / cristae / (folded) inner membrane	**Accept** intermembrane space / double membrane All three correct = 2 marks 1 or 2 correct = 1 mark	(2)

Question Number	Answer	Additional Guidance	Mark
5(b)	An answer that makes reference to the following: • diagram that (roughly) shows the shape and position of the cristae (minimum of 7 cristae at least half width of drawing) (1) • diagram that has no overlapping lines, breaks in lines, shading (1)		(2)

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	**The only correct answer is D** **A** is incorrect because 74 000 ÷ 0.9 = 82 222 **B** is incorrect because 74 000 ÷ 0.9 = 82 222 **C** is incorrect because 74 000 ÷ 0.9 = 82 222		(1)

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	An answer that makes reference to the following: • 0.12 (195...) or 0.12 (162…) μm (1)	**Accept** ECF from Q5ci) A 8.33(3333) μm B 1.21(951…) or 1.21(621…) μm C 0.83(3333) μm	(1)

Question Number	Answer	Additional Guidance	Mark
5(d)	An explanation that makes reference to the following: • because (many) specimens / cells, will be colourless / not be visible (without a stain) (1) • because electron microscope uses electrons to show (electron) dense areas (1)	**Accept** stains provide a contrast **Accept** electrons are not absorbed/scattered by coloured stains / electron microscopes need to use heavy metals	(2)

Question Number	Answer	Additional Guidance	Mark
6(a)	**The only correct answer is A** **B** is incorrect because Ebola has a helical capsid and an envelope whereas HIV has a polyhedral capsid **C** is incorrect because Ebola has a helical capsid and an envelope whereas λ (lambda) phage does not have an envelope and has a complex capsid **D** is incorrect because Ebola has a helical capsid and an envelope whereas TMV does not have an envelope		(1)

Question Number	Answer	Additional Guidance	Mark
6(b)	A description that makes reference to two of the following: • globular / 3D / tertiary protein (1) • held together by {hydrogen bonds / disulfide bridges / ionic bonds/hydrophobic (interactions)} (1) • between R groups (1) • has an active site (1)	**Accept** hydrophobic R groups on inside /hydrophilic R groups on outside = mp 2 & 3	(3) EXP

Question Number	Indicative content	
***6(c)**	Indicative content: Lytic Cycle **(L)** • virus attaches/binds to (host) cells • (viral) genetic material / provirus, inserted (into host cell) • viral proteins/capsid made • **genetic material /(viral) RNA**, replicates • new viral particles assembled • cell ruptures/viral particles, released Haemagglutinin **(H)** • binds to sialic acid groups on the {glycoproteins / cell membrane / host cell / mucus} • so that it can <u>infect</u> host cell • needed by new virus particles to attach to more (host) cells Neuraminidase **(N)** • needed to separate virus particles from the {(non-host) cells / membrane} that they attach to • breaks down mucus • cleave the haemagglutinin from the sialic acid group on cell • needed to separate the new virus particles from each other • needed to separate the new virus particles from the host cell membrane (that they have budded out of) • needed to release the new virus particles from mucus • so that they are free to attach to new host cells • so that the infection is spread	**Level 1:** 1 mark = 1 point from L, H or N 2 marks = 2 points from L, H or N **Level 2 :** 3 marks = 3 points from at least two of L, H or N 4 marks = 4 points from at least two of L, H or N **Level 3 :** 5 marks = 5 points from L, H and N 6 marks = 6 points from L, H and N

Question Number	Answer	Additional Guidance	Mark
7(a)	An answer that makes reference to the following: • a {vertical / upward sloping} line that shows the DNA content increasing (before mitosis) **and** a {vertical / downward sloping} line that shows the DNA content decreasing (after/towards end of mitosis) (1) • a horizontal line extending across all of mitosis (1) • DNA doubles after replication and returns to same level indicated at start (halves) (1)		(3)

Question Number	Indicative content	
***7(b)**	Indicative content: DNA replication **(D)** • reference to semi-conservative replication • helicase {separates the DNA strands / break hydrogen bonds between DNA strands} • each DNA strand acts as a template • bases complementary base pair with the exposed bases (on template strands) • DNA polymerase joins together (adjacent) DNA nucleotides • each new molecule (of DNA) has one old strand and one new strand • number of molecules doubles each time so total width of bands doubles each time Stage 1 **(S1)** • bases contain {heavy nitrogen / 15 N } • only one band near bottom of tube, as all the DNA has {heavy nitrogen / ^{15}N } Stage 2 **(S2)** • DNA replication occurs using the { light nitrogen / ^{14}N } • new strands will contain light nitrogen / ^{14}N } • only one band as all new molecules / DNA have one heavy and one light strand • band higher up in the tube as it is lighter than the {original / stage 1} DNA Stage 3 **(S3)** • new strands will contain { light nitrogen / ^{14}N } • (two bands because) {original / stage 1 / heavy nitrogen / ^{15}N strands} will bind with lighter strands to form {medium weight DNA molecules / band in same position as stage 2 } • (two bands because) light strands from stage 2 molecules will bind with new light strands to form lightest molecules, so will be higher up the tube • bands of equal widths as equal number of light and heavy strands in stage 2 DNA	**Level 1:** 1 mark = 2 details from D, S1, S2, S3 or S4 2 marks = 3 details from D, S1, S2, S3 or S4 **Level 2:** 3 marks = 4 details from **two** of D, S1, S2 S3 or S4 4 marks = 4 details from **three** of D, S1, S2 S3 or S4 **Level 3:** 5 marks = 5 details from **four** of D, S1, S2 S3 or S4 6 marks = 5 details from **all** of D, S1, S2 S3 and S4

	Stage 4 **(S4)** • all new strands contain { light nitrogen / ^{14}N } • (two bands because) {original / stage 1 / heavy nitrogen / ^{15}N strands} will bind with lighter strands to form {medium weight DNA molecules / band in same position as stage 2 / band in same position as the last stage} • (two bands because) light strands from stage 2 molecules will bind with new light strands to form lightest molecules, so will be { higher up the tube / in same position as the last stage } • more light strands in stage 3 DNA that heavy strands so the width of band for lightest DNA will be wider • in a ratio of 3 : 1	

Question Number	Answer	Additional Guidance	Mark
8(a)			(3)

Polysaccharide	Type of glycosidic bond: both 1-4 and 1-6	1-4 only	1-6 only	neither 1-4 nor 1-6
cellulose	□	**X**	□	□
glycogen	**X**	□	□	□
starch	**X**	□	□	□

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	A description that makes reference to the following: • deciding on colours is subjective / people may judge colours differently / hard to distinguish between some colours (1) • the values for the concentration of sugars are ranges / semiquantitative / an { accurate / exact } sugar concentration can not be determined (1)	**Accept** *idea that* 1500 is both yellow and orange **Accept** *idea that* the ranges of concentration are large	(2)

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	An answer that makes reference to four of the following: • carry out test for reducing sugar (1) • use chart to determine concentration of glucose / sucrose (1) • carry out test for non-reducing sugar on the same volume of solution (1) • heat in (HCl) acid (1) • (then) neutralise (1) • add same { volume/ number of drops } of Benedict's solution (1) • subtract the concentration of glucose from the total concentration to determine sucrose concentration (1)	**Accept** description of test (Benedict's, **plus** heat –) for reducing and non-reducing **Accept** alternative method e.g mass or use of colorimeter **Accept** stated volumes **Accept** hydrolyse sucrose / sugar	(4)

Question Number	Answer	Additional Guidance	Mark
9(a)(i)	An explanation that makes reference to the following: • phosphate heads are {polar / charged / hydrophilic}, so interact with / face the aqueous environment (inside and outside of cell) (1) • fatty acid tails form a {non-polar / hydrophobic } barrier / layer (on inside) (1) • (so control the) movement of { polar/charged / non-lipid soluble / water soluble } molecules into and out of the cell (1)	**Accept** waterproof layer **Accept** (only) allow lipid soluble molecules through	(3)

Question Number	Answer	Additional Guidance	Mark
9(a)(ii)	• number of phospholipids in 1 μm^2 calculated (1) • number of phospholipids in bilayer given (1) • answer in standard form (1)	Example of calculation: 1 000 000 ÷ 0.3 = 3 333 333.3333 **1** mark for 1 000 000 ÷ 0.3 / 3 333 333.3333 **Accept** x 2 as ecf from mp 1 3 333 333.3333 × 2 = 6 666 666.7 / 6 666 666.67 **2** marks for 6 666 667 /6 666 666.67 **Accept** answers in standard form as ecf for mp1 or 2 **2** marks for 3.3 x10^6 6.7 × 10^6 with no working out gains 3 marks	(3)

Question Number	Answer	Additional Guidance	Mark
9(b)(i)	A description that makes reference to the following: • number of carbons/hydrogens in the fatty acid tail (1) • the number of carbon carbon double bonds (1)	**Accept** length of fatty acid tail /different R group chain **Accept** some are saturated / monounsaturated / polyunsaturated **Accept** different alcohol groups attached to phosphate **Accept** some have only one fatty acid tail and some have more	(2)

Question Number	Answer	Additional Guidance	Mark
9(b)(ii)	An answer that makes reference to three of the following: **Similarities (max 2)** • all contain all four types of phospholipid (1) • A is the commonest in all four types of membrane (1) • B has the second highest percentage in all four types (1) **Differences (max 2)** • each membrane has a different { ratio/ percentage } of the four types of phospholipid (1) • C has the lowest percentage in the cell membrane and D has the lowest percentage in the other types of membrane (1) • the relative proportions of B, C and D are different in the cell membrane compared with the other three types of membrane (1)	**Accept** D is lowest in all except the cell membrane **Accept** description of the order of the types	(3)

Question Number	Answer	Additional Guidance	Mark
9(b)(iii)	An explanation that makes reference to the following: • when vesicles containing { proteins / (poly)peptides / lipids / steroids } from the endoplasmic reticulum fuse with the Golgi apparatus (1) • some of the membrane of the Golgi apparatus comes from the endoplasmic reticulum (1)	**Accept** vesicles from ER move to the Golgi apparatus where proteins are modified	(2)