



Mark Scheme (Results)

January 2024

Pearson Edexcel International Advanced
Subsidiary Level In Biology (WBI11)
Paper 01: Molecules, Diet, Transport and
Health

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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	An answer that includes the following points (in order): • haemoglobin (1) • high (1) • pulmonary vein (1) • left ventricle (1) • Bohr (shift) (1)	ACCEPT haem / Hb / iron ion / Fe²⁺ ACCEPT higher / above / greater / more DO NOT ACCEPT artery / vena cava ACCEPT l. ventricle / left ventricle {wall / muscle} ACCEPT phonetic spellings e.g. Boar, Bore, Bor, Boh names with lower case	(5)

Question number	Answer	Additional guidance	Mark
2(a)	A description that includes the following points: • three {bases / nucleotides} code for one amino acid (1) • credit any amino acid and its code shown in the table or diagram (1)	e.g. AAA codes for lysine	(2)

Question number	Answer	Additional guidance	Mark
2(b)	A description that includes the following points: • each base is only used once / each base belongs to one codon / three bases are read and then the next three (1) • credit any example taken from the table or diagram (1)	ACCEPT bases are not shared between codons codons are separate but adjacent triplet / code for codon e.g. each A in AAA is only used once AAA is read and then GCA	(2)

Question number	Answer	Additional guidance	Mark
2(c)	A description that includes the following points: • amino acids have more than one {codon / code / triplet} (1) • credit any amino acid and two of its codes shown in the table (1)	ACCEPT all / some e.g. AAA and AAG codes for lysine	(2)

Question number	Answer	Additional guidance	Mark
3(a)	The correct answer is C <i>A is incorrect because active transport can move solutes against the concentration gradient</i> <i>B is incorrect because active transport can move solutes against the concentration gradient</i> <i>D is incorrect because water moves in osmosis not solutes</i>		(1)

Question number	Answer	Additional guidance	Mark
3(b)	The correct answer is A <i>B is incorrect because only active transport involves proteins</i> <i>C is incorrect because only active transport involves proteins</i> <i>D is incorrect because only active transport involves proteins</i>		(1)

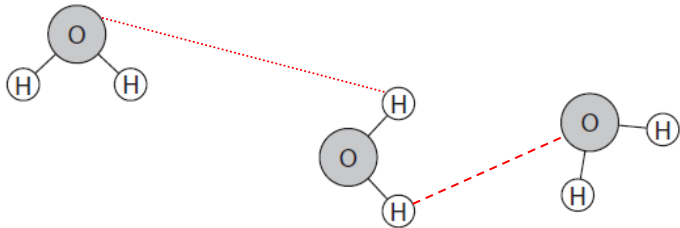
Question number	Answer	Additional guidance	Mark
3(c)	The correct answer is B <i>A is incorrect because active transport does not move large particles or bacteria</i> <i>C is incorrect because exocytosis moves matter out of the cell</i> <i>D is incorrect because facilitated diffusion does not move large particles or bacteria</i>		(1)

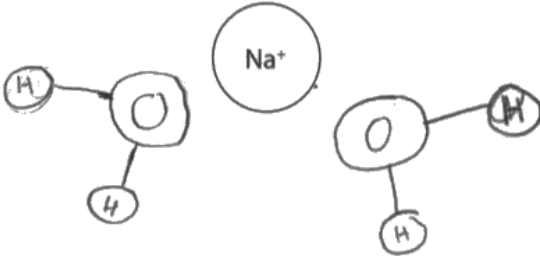
Question number	Answer	Additional guidance	Mark
3(d)	The correct answer is B <i>A is incorrect because lipid-soluble molecules can move directly through the membrane by diffusion</i> <i>C is incorrect because lipid-soluble molecules can move directly through the membrane by diffusion</i> <i>D is incorrect because osmosis is the movement of water</i>		(1)

Question number	Answer	Additional guidance	Mark
3(e)	The correct answer is B <i>A is incorrect because polar R groups cannot interact with the phospholipid tails</i> <i>C is incorrect because polar R groups cannot interact with the phospholipid tails and non-polar R groups cannot interact with the polar molecules passing through the channel</i> <i>D is incorrect because polar R groups are needed to allow polar molecules through</i>		(1)

Question number	Answer	Additional guidance	Mark
3(f)	An explanation that includes four of the following points: • (change in mass / movement of water) is due to <u>osmosis</u> (1) • potato decreased mass in {purple / orange} solutions because the solutions were more concentrated than the {potato / cytoplasm} (1) • decrease in mass was greatest in orange solution as this was more concentrated than the purple solution (1) • potato increased in mass in the red solution as the concentration of the solution was less than that of the {potato / cytoplasm} (1) • no change in mass in blue solution as the concentration of the solution and the {potato / cytoplasm} were the same (1)	NB ACCEPT converse explanations Penalise once water concentration NB more concentrated solution = lower water potential lower solute potential lower osmotic potential less dilute hypertonic NB less concentrated solution = higher water potential higher solute potential higher osmotic potential more dilute hypotonic ACCEPT isotonic no <u>net</u> movement of water same water potential same solute potential same osmotic potential	(4)

Question number	Answer	Additional guidance	Mark
4(a)(i)	An explanation that includes the following points: - the oxygen (atom) is slightly negative and the hydrogens (atoms) are slightly positive} (1) {there is (an uneven) charge distribution (across the molecule) / uneven distribution of electrons / the oxygen pulls the electrons towards it} (1)	Penalise ref to molecules once ACCEPT δ -ve / δ +ve from a diagram ACCEPT comparisons of electronegativity unbalanced charge oxygen has more {protons / more positive nucleus} electrons closer to the oxygen	(2)

Question number	Answer	Additional guidance	Mark
4(a)(ii)	a line drawn between an O of one molecule and a H of another molecule (1)	 If more than one H bond shown then they must be both correct and using different atoms on any one molecule If other water molecules draw then mark if correct	(1)

Question number	Answer	Additional guidance	Mark
4(b)	water molecules clustered around the Na^+ with the O facing the Na^+ and the Hs facing away (1)	NB if charges are shown, they must be correct and partial ACCEPT any number of water molecules but all must be correct DO NOT ACCEPT circles overlapping solid lines joining circles 	(1)

Question number	Answer	Additional guidance	Mark
4(c)	A description that includes four of the following points: • (A) (increase in temperature can) (linear) increase the solubility (1) • (B) (increase in temperature (up to 32°C) can) (exponentially) increase the solubility and then decrease it (1) • (C) (increase in temperature can have) a slight increase on the solubility (1) • (D) (increase in temperature can) decrease the solubility (1) • statement referring to different chemicals have different solubilities at different temperatures (1)	ACCEPT positive correlation ACCEPT no effect ACCEPT negative correlation	(4)

Question number	Answer	Additional guidance	Mark
5(a)(i)	• waist-to-hip ratio / skin fold thickness / waist (circumference) (1)	ACCEPT / WHR / hip to waist ratio / waist size / waist measurement / waist to hip index / percentage body fat / skin fold measurement IGNORE BMI / body mass index / pinch test / mass / weight	(1)

Question number	Answer	Additional guidance	Mark
5(a)(ii)	The correct answer is B <i>A is incorrect because 23 is this value rounded down</i> <i>C is incorrect because the mass is divided by the height² not the height</i> <i>D is incorrect because the mass is divided by the height² not the height</i>		(1)

Question number	Answer	Additional guidance	Mark
5(a)(iii)	The correct answer is B <i>A is incorrect because a person is obese if they have a BMI of 30</i> <i>C is incorrect because a person who is obese has a BMI of 30 or more not less than 30</i> <i>D is incorrect because a person who is obese has a BMI of 30 or more not less than 30</i>		(1)

Question number	Answer	Additional guidance	Mark
5(b)	- decrease {calorie / energy / fat / sugar / carbohydrate} intake AND increase {exercise / activity} (1) - use more energy than consumed (1)	NB Answer needs to be in the form of a change ACCEPT start taking weight-reducing medications have a gastric band IGNORE {regular / daily} exercise ACCEPT calorie deficit	(1)

Question number	Answer	Additional guidance	Mark
5(c)(i)	The correct answer is C <i>A is incorrect because condensation is making bonds not splitting them</i> <i>B is incorrect because condensation is making bonds not splitting them</i> <i>D is incorrect because amylose has 1-4 glycosidic bonds and not 1-6</i>		(1)

Question number	Answer	Additional guidance	Mark
5(c)(ii)	An answer that includes the following points: • because {starch / amylose } were not broken down as well (1) • less {glucose / sugar} {to convert to fat / so fat broken down} (1)	ACCEPT not broken down hydrolysed less maltose / glucose formed ACCEPT less {glucose / sugar} absorbed (into blood) some {starch / amylose} lost in faeces DO NOT ACCEPT starch absorbed	(2)

Question number	Answer	Additional guidance	Mark
5(d)(i)	An explanation that includes the following points: • (correlation) because a change in one variable is reflected by a change in another variable (1) • (positive) because as one factor increased, so did the other (1)	NB penalise reference to ‘causes’ once IGNORE explanations ACCEPT pattern between the two factors ACCEPT <u>both</u> changes are increases as <u>both</u> weight loss and {replication / number of bacteria} increase	(2)

Question number	Answer	Additional guidance	Mark
5(d)(ii)	An answer that includes the following points: • {replication / bacteria} uses {energy / glucose / sugar} (in the digestive system) (1) • therefore less available {for absorption / to store as fat} (1)	ACCEPT feeding / fatty acids / glycerol / amino acids IGNORE food / nutrients ACCEPT so person breaks down fat (reserves)	(2)

Question number	Answer	Additional guidance	Mark
6(a)	fluid mosaic (model) (1)	ACCEPT mosaic fluid IGNORE phospholipid / bilayer	(1)

Question number	Answer	Additional guidance	Mark
6(b)	A description that includes the following points: - in {a bilayer / 2 layers} (1) {phosphate / heads} pointing towards {aqueous environments / inside and_outside of the cell} (1) {fatty acids / tails} pointing {into the membrane / away from the water / towards each other} (1)	ACCEPT outwards / named environments ACCEPT inwards	(3)

Question number	Answer	Additional guidance	Mark
6(c)(i)	$r^3 = 0.027$ (1) $r = 0.3$ (1) $d = 0.6$ (1)	π on calculator $r^3 = 0.0258$ π on calculator $r = 0.2954$ π on calculator $d = 0.5908 = 0.6$ Bald answer of 0.027 = 1 mark Bald answer of 0.3 = 2 marks Bald answer of 0.6 = 3 marks	(3)

Question number	Answer	Additional guidance	Mark
6(c)(ii)	A description that includes three of the following points: • single-stranded (1) • (mRNA / mononucleotides) consist of <u>ribose</u>, phosphate and {a base / correctly named base} (1) • phosphodiester bonds between {(mono)nucleotides / phosphate and sugar} (1) • adenine, uracil, cytosine and guanine (1)	NB piece together DO NOT ACCEPT T / thymine	(3)

Question number	Answer	Additional guidance	Mark
6(c)(iii)	An explanation that includes three of the following points: • description of arrangement of {phospholipids / heads / tails} (1) • heads pointing outwards because they are polar and interact with water (environment) / hydrophobic fatty acids point away from the water (environment) (1) • mRNA surrounded by {phosphate / heads} as mRNA {is a polar molecule / has a phosphate group} (1) • {fatty acid / tails} (of both groups) facing each other because they are hydrophobic (1)	e.g. heads facing {out of the nanoparticle / mRNA} tails facing each other ACCEPT hydrophilic for polar DO NOT ACCEPT attraction of phosphate heads	(3)

Question number	Answer	Additional guidance	Mark
7(a)	A description that includes three of the following points: • {CFTR (protein) / (CFTR) protein} cannot function properly (1) • credit details of dysfunction (1) • mucus will be (very) {thick / sticky} (1) • gases will not be able to move through the mucus properly (1)	ACCEPT change in shape / structure / e.g. reduced transport of chloride ions out of the cell sodium ions move into the cell water leaves the mucus and enters the cell chloride ions remain in the cell ACCEPT oxygen (out of lungs) air (but not diffusion of air) mucus blocks airways	(3)

Question number	Answer	Additional guidance	Mark
7(b)(i)	• 13 / 13.0 / 12.97 (%) (1)		(1)

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes three of the following points: • {more / improved} (genetic) screening (1) • more carriers identified (1) • because more {couples choosing IVF / (IVF) identification of affected embryos more reliable} (1) • more couple choosing not to have child (1) • as the frequency of the CF allele decreases in the population there will be a decrease in the CF phenotype (1) • more migration / change in population diversity (1)	ACCEPT named type of screening e.g. PGD ACCEPT fewer false negatives (in people) more (types of) mutations identified (in people) ACCEPT fewer false negatives (in embryo) more (types of) mutations identified (in embryo) fetus DO NOT ACCEPT baby / child ACCEPT more choosing adoption	(3)

Question number	Answer	Mark
*7(c)	Regimen outlined • before inhalation, drug A must be administered • because they are looking at pre-treatment • a placebo needs to be given to another group • to see the effect of drug A over no pre-treatment / to eliminate bias • inhalation daily • as it is unlikely to stay in the body very long • run trial for weeks (minimum 4 weeks) • as results will not be immediate Design of trial • two / three groups of patients with CF (minimum 6 per group) • one to receive drug A and the other to receive a placebo • large number of patients in each group • for repeatability • patients should be of similar {age / sex / severity of CF} • for validity • should not be receiving other medications • as these may mask the effects of drug A and inhalation • double blind trial • to avoid bias What is measured • volume / mass of mucus removed • to see if clearance of mucus has improved • lung function tests / spirometer, peak flow • to see if lung function has improved • give a questionnaire • to assess improvements in quality of life • as these are the parameters being tested • use of statistics to analyse the results • to determine the significance of the data	(6)

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.	Simple descriptions of investigation 1 mark = one description 2 marks = three descriptions
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.	Some explanation given of a trial 3 marks = one explanation 4 marks = two explanations
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.	More extensive explanation given 5 marks = three explanations 6 marks = four explanations for an investigation that will work

Question number	Answer	Additional guidance	Mark
8(a)	An answer that includes the following points: • at least one carbon-carbon double bond drawn (1) • rest of diagram correct (remaining CC single bonds and {Hs added /Lewis structures}) (1)	DO NOT ACCEPT double bond between C1 and C2 ecf from double bond between C1 and C2 ecf from saturated fatty acid	(2)

Question number	Answer	Additional guidance	Mark
8(b)(i)	• 1.1 / 1.14 / 1.136 (1)		(1)

Question number	Answer	Additional guidance	Mark
8(b)(ii)	• 1.5 : 1 / 1.45 : 1 (1)		(1)

Question number	Answer	Additional guidance	Mark
8(b)(iii)	• 0.022 (1) • 22 000 / 2.2×10^4 (1)	Bald answer of 22000 / 2.2×10^4 = 2 marks Bald answer of 22 of any magnitude or incorrect standard form format = 1 mark	(2)

Question number	Answer																																					
*8(b)(iv)	Graph 1 : surface area of arteries Conclusions : - arteries have lesions with both lipids - percentage of surface covered in lesions increases with time for <u>both</u> sat and unsat lipids (overall) increase is greater (over time) with sat lipid / converse - type of lipid in diet does influence the percentage of arteries covered with lesions - data may not be {valid as no experimental details / repeatable as no error bars} (only once) Graph 2 : % atherosclerosis Conclusions : - atherosclerosis occurs with both lipids - atherosclerosis is higher with sat lipids in all three ages /converse - percentage increases with age for sat lipids - age has a less clear effect with unsat lipids - data may not be {valid as no experimental details / repeatable as no error bars / significant as no stats test} (only once) Graph 3 : area of atheroma Conclusions : - atheromas are larger in <u>both</u> males and females with sat lipids than unsat lipids - males have atheromas of greater area than females whichever lipid they are given - sex is an influence on area as well - data likely to be significant because error bars do not overlap - male data more variable Key saturated lipids unsaturated lipids Graph 1 Percentage of surface of arteries covered in lesions (%) <table><thead><tr><th>Age / months</th><th>saturated lipids (%)</th><th>unsaturated lipids (%)</th></tr></thead><tbody><tr><td>16</td><td>2</td><td>4</td></tr><tr><td>32</td><td>18</td><td>16</td></tr><tr><td>60</td><td>52</td><td>38</td></tr></tbody></table> Graph 2 Percentage of primates with atherosclerosis (%) <table><thead><tr><th>Age / months</th><th>saturated lipids (%)</th><th>unsaturated lipids (%)</th></tr></thead><tbody><tr><td>16</td><td>18</td><td>12</td></tr><tr><td>32</td><td>32</td><td>22</td></tr><tr><td>60</td><td>55</td><td>20</td></tr></tbody></table> Graph 3 Mean area of atheroma after 60 months / mm² <table><thead><tr><th>Lipid Type</th><th>Sex</th><th>Mean area (mm²)</th></tr></thead><tbody><tr><td rowspan="2">saturated lipids</td><td>Males</td><td>0.028</td></tr><tr><td>Females</td><td>0.005</td></tr><tr><td rowspan="2">unsaturated lipids</td><td>Males</td><td>0.008</td></tr><tr><td>Females</td><td>0.0</td></tr></tbody></table>	Age / months	saturated lipids (%)	unsaturated lipids (%)	16	2	4	32	18	16	60	52	38	Age / months	saturated lipids (%)	unsaturated lipids (%)	16	18	12	32	32	22	60	55	20	Lipid Type	Sex	Mean area (mm²)	saturated lipids	Males	0.028	Females	0.005	unsaturated lipids	Males	0.008	Females	0.0
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Level 0	0	No awardable content	
Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. Vague statements related to consequences are made with limited linkage to a range of scientific ideas, processes, techniques and procedures. The discussion will contain basic information with some attempt made to link knowledge and understanding to the given context.	Simple descriptions of data 1 mark = description of data in one graph 2 marks = description of data in two graphs
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts / concepts. Consequences are discussed which are occasionally supported through linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows some linkages and lines of scientific reasoning with some structure.	Extended links made 3 marks = description of data in three graphs 4 marks = conclusion for one graph
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant biological facts / concepts. Consequences are discussed which supported throughout by sustained linkage to a range of scientific ideas, processes, techniques and procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.	Understanding of graphs used to comment on effect of dietary supplements 5 marks = conclusion for two graphs 6 marks = conclusion for three graphs

Question number	Answer	Additional guidance	Mark
8(b)(v)	An answer that includes three of the following points: Unethical : • may cause {pain / harm / discomfort} / it is cruel (1) • animals may die (1) • animals should not be kept in captivity / being kept in captivity caused stress (1) • animals unable to consent (1) Ethical : • it is more ethical than experimenting on humans (1) • primates are (more) similar to humans (than other animals) (1) • might improve {human / animal} health (in future) (1)	ACCEPT may cause health issues ACCEPT against their will they have no say in the matter have not given their permission animals have their own rights ACCEPT humans are more important {should not harm / kill} humans	(3)

