



Mark Scheme (Results)

June 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	Mark
1(a)	The only correct answer is A <i>B is incorrect because the only elements present in all amino acids are carbon, hydrogen, oxygen and nitrogen</i> <i>C is incorrect because the only elements present in all amino acids are carbon, hydrogen, oxygen and nitrogen</i> <i>D is incorrect because the only elements present in all amino acids are carbon, hydrogen, oxygen and nitrogen</i>	(1)

Question number	Answer	Mark
1(b)	The only correct answer is C <i>A is incorrect because amino acids are not held together by ester bonds</i> <i>B is incorrect because amino acids are not held together by ester bonds</i> <i>D is incorrect because hydrolysis breaks bonds not forms them</i>	(1)

Question number	Answer	Additional guidance	Mark
1(c)	A description that makes reference to three of the following points: • (chain) becomes {secondary structure / alpha-helix / (beta) pleated sheet (1) • (secondary structure) becomes {tertiary / quaternary / 3D / globular} structure (1) • with an active site (1) • with hydrophilic <u>R groups</u> arranged on the outside OR credit named bond between the <u>R groups</u> for either secondary or tertiary structure (1)	e.g. hydrogen bonds (only) for secondary structure hydrogen bonds / disulfide {bridges / bonds} / ionic bonds / hydrophobic interactions for tertiary DO NOT ACCEPT if wrongly named bonds are given	(3)

Question number	Answer	Mark
2(a)(i)	The only correct answer is A <i>B is incorrect because thymine joins with adenine in a DNA molecule</i> <i>C is incorrect because thymine joins with adenine in a DNA molecule</i> <i>D is incorrect because thymine joins with adenine in a DNA molecule</i>	(1)

Question number	Answer	Mark
2(a)(ii)	The only correct answer is D <i>A is incorrect because S is not a phosphodiester bond</i> <i>B is incorrect because R is not a hydrogen bond</i> <i>C is incorrect because R is not a hydrogen bond</i>	(1)

Question number	Answer	Additional guidance	Mark
2(b)	Any two from: substitution insertion deletion	IGNORE point / gene / frameshift / addition / subtraction / named disorders / missense / nonsense / inversion / duplication	(1)

Question number	Answer	Additional guidance	Mark
2(c)	A description that makes reference to two of the following points: • mutation rate in prosimians is the highest (1) • (overall) as the age when breeding starts increases, the mutation rate decreases (1) • age when breeding starts does not affect mutation rate in apes (only) (1) • age when breeding starts affects mutation rate in old world monkeys (only) (1) • mutation rates within each group are very close together except prosimians (1)	ACCEPT negative correlation ACCEPT no evidence of an effect ACCEPT {wide range / great variation} (of mutation rates) in prosimians (compared with others)	(2)

Question number	Answer	Additional guidance	Mark
3(a)	A description that makes reference to two of the following points: - transcription / transcribe the DNA / synthesis of RNA (1) - credit detail of role of RNA polymerase in transcription (1) - repairs mistakes in the (newly-synthesised) RNA (1)	ACCEPT mRNA / tRNA / rRNA DO NOT ACCEPT translation e.g. RNA polymerase: binds to the (DNA) promotor (region), unwinds the DNA (helix), separates the DNA strands, lines up the (RNA) nucleotides on the {DNA / template strand}, forms phosphodiester bonds between (RNA) nucleotides	(2)

Question number	Answer	Additional guidance	Mark
3(b)	An answer that makes reference to at least one similarity and one difference: Similarities: - both {consist of three bases / are three bases / are triplets} (1) Differences: - start codon start translation_and the stop codon ends translation (1) {three / more than one} possible codons for the stop codon but start codon {does not / has only one codon} (1) (first) transfer RNA binds to the start codon but there is not a tRNA for the stop codon (1) - start codon codes for {an amino acid / methionine} but a stop codon does not code for an amino acid (1)	ACCEPT an indication of one triplet and more than one triplet, one code for start but stop code is degenerate ACCEPT stop codon does not	(3)

Question number	Answer	Additional guidance	Mark
3(c)	A description that makes reference to two of the following points: - translation / synthesis of {(poly)peptide (chain) / primary structure (of protein)} (1) - hold {(two) tRNAs together (on the mRNA) / (two) tRNAs on the mRNA} (until) a peptide bond joins (two adjacent) amino acids together (1)	IGNORE protein synthesis DO NOT ACCEPT transcription	(2)

Question number	Answer	Mark
4(a)(i)	The only correct answer is B <i>A is incorrect because P is the vena cava</i> <i>C is incorrect because R is the aorta and P is the vena cava</i> <i>D is incorrect because R is the aorta</i>	(1)

Question number	Answer	Mark
4(a)(ii)	The only correct answer is A <i>B is incorrect because R is the aorta</i> <i>C is incorrect because Q is the pulmonary artery</i> <i>D is incorrect because Q is the pulmonary artery and R is the aorta</i>	(1)

Question number	Answer	Mark
4(a)(iii)	The only correct answer is C <i>A is incorrect because P is the vena cava and the coronary artery branches from the aorta</i> <i>B is incorrect because Q is the pulmonary artery and the coronary artery branches from the aorta</i> <i>D is incorrect because S is the pulmonary vein and the coronary artery branches from the aorta</i>	(1)

Question number	Answer	Additional guidance	Mark
4(b)(i)	Any two from: surface area (of diffusion surface) concentration {gradient / difference} membrane permeability temperature pressure type of molecule	ACCEPT velocity of blood flow concentration {gradient / difference} of appropriate named molecule ACCEPT size, charge	(1)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	Fick's (law) (1)		(1)

Question number	Answer	Additional guidance	Mark																				
4(c)(i)	An answer that makes reference to the following points: <table border="1"> <thead> <tr> <th>Diffusion distance</th><th>Diffusion distance / μm</th><th>Time taken to diffuse the distance</th><th>Time taken to diffuse the distance / mseconds</th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td> 5 000 / 5 000.0 / 5×10^3 </td></tr> <tr> <td></td><td> 1000 / 1000.0 / 1×10^3 </td><td></td><td> 498 000 / 498 000.0 / 4.98×10^5 / 500 000 / 5×10^5 </td></tr> </tbody> </table>	Diffusion distance	Diffusion distance / μm	Time taken to diffuse the distance	Time taken to diffuse the distance / mseconds												5 000 / 5 000.0 / 5×10^3		1000 / 1000.0 / 1×10^3		498 000 / 498 000.0 / 4.98×10^5 / 500 000 / 5×10^5	1 mark = 1 or 2 correct values 2 marks = all correct	(2)
Diffusion distance	Diffusion distance / μm	Time taken to diffuse the distance	Time taken to diffuse the distance / mseconds																				
			5 000 / 5 000.0 / 5×10^3																				
	1000 / 1000.0 / 1×10^3		498 000 / 498 000.0 / 4.98×10^5 / 500 000 / 5×10^5																				

Question	Answer	Additional guidance	Mark
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number			
4(c)(ii)	An explanation that makes reference to three of the following points: - to supply the {cells / tissues} with {oxygen / glucose} (for respiration) (1) - to remove the carbon dioxide (produced) (1) - a small (diffusion) distance results in a faster the rate of {diffusion / exchange} (1) - credit use of data (with at least one comparable unit) to support mp 3 (1)	ACCEPT named cells / tissues e.g. muscle ACCEPT correct reference to time for diffusion for rate converse IGNORE efficiently e.g. it takes 0.5 milliseconds for 1 um but 50 milliseconds for 10um more than {10 / 100} μm away the rate of diffusion would not be fast enough	(3)

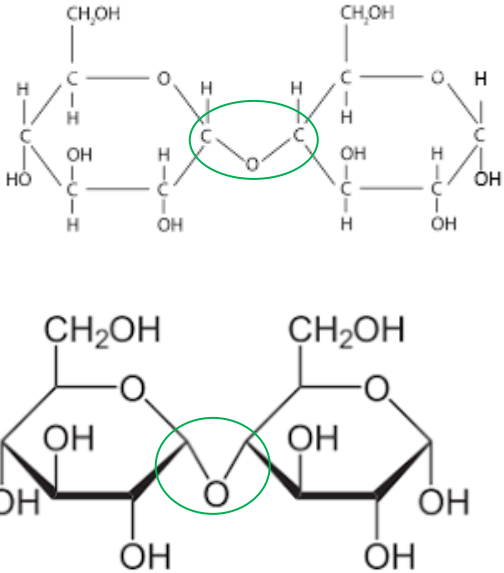
Question number	Answer	Additional guidance	Mark
5(a)	An explanation that makes reference to the following points: - because haemophilia is {sex-linked / sex-linkage} (disorder) (1) - which means the {gene for haemophilia / gene for blood clotting / gene for factor VIII} is located on the X chromosome (1) - therefore males with the {faulty / recessive / haemophilia} allele will have haemophilia (1) - whereas females need to {be homozygous recessive / have two faulty alleles} to have haemophilia (1)	NB Max 3 marks if written in context of colour-blindness and not haemophilia ACCEPT X-linked ACCEPT if dominant and recessive alleles shown on X chromosomes in a diagram NB penalise recessive gene ONCE ACCEPT if clearly indicated on a diagram mutation ACCEPT if clearly indicated on a diagram	(4)

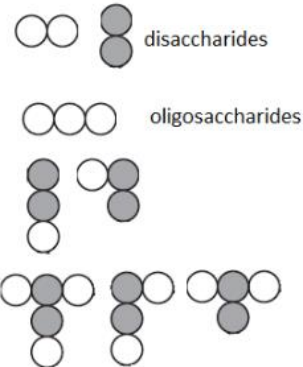
Question number	Answer	Additional guidance	Mark
5(b)(i)	185218 correctly divided by 37988 (1) 4.9 (1)	e.g. 5 / 4.87 / 4.874 / 4.8744 Bald answer of 4.9 = 2 marks Bald answer not to 2 sig figs correctly rounded = 1 mark	(2)

Question number	Answer	Mark
5(b)(ii)	The only correct answer is C <i>A is incorrect because the answer is 2.35×10^{-3}</i> <i>B is incorrect because the answer is 2.35×10^{-3}</i> <i>D is incorrect because the answer is 2.35×10^{-3}</i>	(1)

Question number	Answer	Additional guidance	Mark
5(b)(iii)	credit reasonable suggestion (1)	e.g. people are {dying / being born} all the time (young) people may not be diagnosed yet / won't know not everyone can be counted not everyone is tested / has access to tests not all cases recorded not everyone will know they have haemophilia IGNORE lie / ashamed / won't admit to it / asymptomatic	(1)

Question number	Answer	Additional guidance	Mark
5(c)	An explanation that makes reference to the following points: - as thrombin is an {enzyme / catalyst / catalyses} (1) - without thrombin fibrinogen will not be converted to fibrin (by thrombin) (1) - without fibrin there will be nothing to trap {platelets / blood cells} (1)	NB max 2 marks if no context ACCEPT less fibrinogen converted to fibrin ACCEPT fewer {platelets / blood cells} trapped	(3)

Question number	Answer	Additional guidance	Mark
6(a)	An answer that makes reference to the following points: - glycosidic bond correctly shown (1) - rest of molecule drawn correctly (1) - an indication that (one molecule) water is formed (1)		(3)

Question number	Answer	Additional guidance	Mark
6(b)(i)	An answer that makes reference to the following points: • {one / two} correct diagrams (1) • correct diagrams of one disaccharide and two oligosaccharides (1)	NB diagrams must be white / grey circles touching or with lines joining them  disaccharides oligosaccharides	(2)

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation that makes reference to the following points: • (amylase) {is specific / is complementary / only binds / only fits} {substrates / 1 – 4 glycosidic bonds} (1) • {1 – 4 glycosidic bonds / substrate} can {fit into / bind with} the active site (1)	Must be a reference to 1 – 4 bonds for 2 marks to be awarded or the converse with 1 – 6 bonds ACCEPT (the parts of the glucoses joined by) 1 – 6 glycosidic bonds do not {fit into / bind with} the <u>active site</u> NB the active site (of amylase) is complementary to the 1 – 4 glycosidic bond = 2 marks	(2)

Question number	Answer	Additional guidance	Mark
6(c)(i)	An answer that makes reference to the following points: • by hydrolysis (of glycosidic bonds) (1) • (different) enzymes needed to break each type of (glycosidic) bond (1) • different enzymes needed for {disaccharides and oligosaccharides / each type of oligosaccharide / each type of sugar} (1)		(3)

Question number	Answer	Additional guidance	Mark
6(c)(ii)	An explanation that makes reference to the following points: • because it is a {polar / hydrophilic} molecule (1) • so cannot pass {through / into} the {phospholipids / fatty acids / tails} (which are non-polar) (1)		(2)

Question number	Answer	Additional guidance	Mark
7(a)	• correct calculation (1) • 7.56 (1)	$340 \div 45 = 7.555555555556$ e.g. 8 / 7.6 / 7.556 / 7.5556 etc ACCEPT ecf 8.29 Bald answer of 7.56 = 2 marks Bald answer of 8 / 7.6 / 7.556 / 7.5556 etc / 8.29 = 1 mark	(2)

Question number	Answer
*7(b)	Table 1: • RYR decreases total cholesterol • RYR decreases LDL • studies used different doses and decreases were not consistent • which suggests other factors may be involved • no indication of sample size / information about sex at birth, age, diet /where levels were measured, when levels were measured • therefore <u>valid</u> conclusions cannot be drawn • credit effect of limitation eg if person ate more cholesterol then decrease might be higher, levels measured closer to meal might be higher • discrepancy on effects of HDL / not much data on HDL • LDL : HDL ratio cannot be calculated • and this is more significant than LDL / total cholesterol levels • no indication of repeats • so conclusions will not be <u>valid</u> • no control group • so cannot be certain that the RYR caused the changes Graph 1: • RYR lowers LDL at both doses • levels of LDL increase once RYR not taken anymore • small sample size • no indication of e.g. diet, age, sex at birth, when and where levels were measured • therefore <u>valid</u> conclusions cannot be drawn • credit effect of limitation eg if person ate more cholesterol then decrease might be higher, levels measured closer to meal might be higher • {large / overlapping} {range bars / error bars} • so conclusions will not be <u>valid</u> / RYR may have no significant effect • short term study • so don't know if effects are long term Graph 2: • taking RYR appears to decrease LDL • {large / overlapping} {range bars / error bars} • so conclusions will not be <u>valid</u> / RYR may have no significant effect • no indication what the , what the dose was, what the time scale was • credit specific effect of limitation eg if person ate more cholesterol then decrease might be higher, levels measured closer to meal might be higher, no timescale no indication of how long drop in LDL took

			Additional guidance
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.	Descriptions of data 1 mark = one description 2 marks = at least two descriptions of data from two different sources of data
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.	Limitations of data 3 marks = one limitation described 4 marks = at least two limitations described from two different sources of data
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.	Implications of limitation 5 marks = one implication of one limitation given 6 marks = at least one implication described for two limitations described from two different sources of data

Question number	Answer	Additional guidance	Mark
7(c)(i)	• credit two from: headache pins and needles hair loss acne allergic reaction / rash / hives dizziness memory loss / confusion feeling sick / nausea / vomiting feeling unusually tired / fatigue / physically weak stomach pain digestive system problems, such as constipation, diarrhoea, indigestion or farting loss of appetite (type II) diabetes impotence muscle {pain / tiredness / weakness / damage} joint {pain / swelling} tendon problems sleep problems low blood platelet count liver damage / hepatitis / yellowing of {eyes / skin} / dark-coloured urine kidney failure		(1)

Question number	Answer	Additional guidance	Mark
7(c)(ii)	A description that makes reference to four of the following points: • large group of people (1) • people who are {healthy / have no known illnesses} (1) • {control / same} {age / sex at birth / ethnicity / lifestyle / etc} (1) • one group given placebo and one given monacolin K (1) • monitored for side effects (1) • statistical analysis of data (on side effects) / T test (1)	ACCEPT minimum size of 100 ACCEPT not taking other medications DO NOT ACCEPT patients DO NOT ACCEPT contradictions ACCEPT given a control (substance) IGNORE use of different doses ACCEPT over a period of time minimum of a month ACCEPT analysis of Mann-Whitney U / Z test / standard deviation	(4)

Question number	Answer	Additional guidance	Mark
7(c)(iii)	An answer that makes reference to two of the following points: • difficult to eliminate the effects of a named factor that cannot be controlled (1) • psychological effects / placebo effect / assumption that they are taking monacolin (1) • cannot quantify the extent of the side effect (1) • different people may react differently to the drug (1) • ethics of giving someone an untested drug (1) • some side effects may {be rare / occur after a long period of time / not be detected} (1)	e.g. diet, activity levels ACCEPT assessment of side effect is subjective ACCEPT people are genetically different side effects may not affect the group of people in the study ACCEPT moral / not right for ethical side effects could be fatal	(2)

Question number	Answer	Additional guidance	Mark
8(a)	A description that makes reference to the following points: • (protein that) consists of 4 {subunits / (poly) peptides} (1) • has (four) {haem / non-protein / prosthetic} groups (1) • {iron ion / ferric iron / Fe²⁺} (attached to each subunit / haem) (1)	ACCEPT α and β, α and γ, δ and ε DO NOT ACCEPT α helix / β sheet IGNORE proteins, bonds DO NOT ACCEPT iron NB Has four haem groups that contain iron ion = 2 marks	(3)

Question number	Answer
*8(b)	Mean number of cells per dm³ of blood • no correlation with size of mammal / some indication that as size of mammal decreases the number increases, with the exception of camels Mean mass of haemoglobin: • some indication that mass of haemoglobin per cell decreases with size of mammal, with the exception of camels / man • mammals with high numbers of red blood cells have lower mean mass of haemoglobin per cell / converse • total mass of haemoglobin decreases with size of mammal • because high number would partially compensate for less haemoglobin as the smaller mammal may require less energy • so respiration would be less • total mass of haemoglobin decreases with size of mammal Mean cell volume: • cell volume decreases with size of land mammals, except camels • possibly because their blood vessels are narrower • cell volume of camels is particularly large • possibly because their blood vessels are wider • as more heat needs to be lost in the hot temperatures Oxygen-carrying capacity: • oxygen carrying capacity of blood decreases with decrease in size of mammal • oxygen-carrying capacity decreases with total mass of haemoglobin • as the smaller mammal may require less energy • so respiration would be less Overall: • these three factors determine the oxygen-carrying capacity of the blood • but other factors would also affect oxygen-carrying capacity • e.g. affinity of haemoglobin for oxygen • beluga whales have relatively small cells but high mass of haemoglobin and high concentration enabling their high oxygen-carrying capacity • as swimming takes a lot of energy • as the water they live in is cold • and energy is needed to keep warm • therefore rate of respiration is high • and the animals have to surface to acquire their oxygen from the air

			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 data / correct comments not related to data / attempt but not accurate description of trends 1 mark = one description / comment 2 marks = two descriptions / comments
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.	Trends / lack of trends described with some explanation 3 marks = one correct trend described / an inaccurate trend explained 4 marks = one trend plus a simple explanation of data
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.	Explanations of data 5 marks = more than a simple explanation of a trend 6 marks = explanation that shows some linkage of data sets, that is discussed in relation to size of mammal

Question number	Answer	Additional guidance	Mark
8(c)(i)	• 26 (1) • 23 (1)	Bald answer of 23 = 2 marks Bald answer of 26 = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
8(c)(ii)	A description that makes reference to the following points: - as partial pressure (of oxygen) drops from 12 to {1 / 2 / 3 / 4} (kPa) the percentage saturation of oxygen {remains at 80 to 100 % / remains fairly constant / drops slightly} (1) - partial pressure (of oxygen) drops sharply at low levels of oxygen (1) OR - percentage saturation (of oxygen) drops sharply below {1 / 2 / 3 / 4} (kPa) (1) - percentage saturation (of oxygen) {remains at 80 to 100 % / remains fairly constant / drops slightly} at high partial pressures (1)	NB Penalise reference to rate once ACCEPT converse throughout ACCEPT value within the range of 1 and 4 which lies on a grid line ACCEPT value within the range of 1 and 4 which lies on a grid line	(2)

Question number	Answer	Additional guidance	Mark
8(c)(iii)	An answer that makes reference to two of the following points: - because myoglobin has a higher affinity for oxygen (than haemoglobin) (1) - so that it will (only) release the oxygen when partial pressures are low (1) - because haemoglobin cannot supply enough oxygen to respiring muscle cells / so that myoglobin can supply <u>enough</u> oxygen to respiring muscle cells (1)	ACCEPT converse stronger {binding / association} with oxygen IGNORE easier / better ACCEPT converse ACCEPT muscle cells need <u>more</u> oxygen for respiration (than other cell types)	(2)

