Mark Scheme (Results)

January 2023

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

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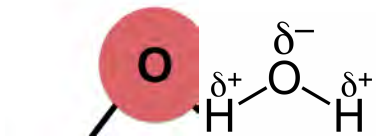
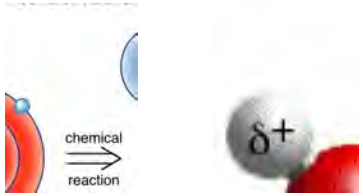
General Marking Guidance

- 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(a)	A diagram that includes the following: • 2 hydrogens joined to an oxygen (by covalent bonds) (1) • the charge distribution with a delta sign or some indication it is a small charge (1)	e.g. lines, overlapping circles, shared electrons, touching   	**(2)**

Question number	Answer	Mark
1(b)		(3)

Statement	Carbohydrates			
	both monosaccharides and polysaccharides	monosaccharides only	polysaccharides only	neither monosaccharides nor polysaccharides
Have the general formula $C_nH_{2n}O_n$	☐	☒	☐	☐
Have glycosidic bonds	☐	☐	☒	☐
Have little effect on water potential	☐	☐	☒	☐

Question number	Answer	Additional guidance	Mark
2(a)	A description that includes three of the following points: • fibrous (protein) (1) • composed of {three (polypeptide) chains in a helix / three-stranded helix / triple helix} (1) • held by hydrogen bonds between the chains (1) • credit details of the chains (1)	e.g. every third amino acid is glycine / repeating sequences of amino acids / high proportion of {glycine /	(3)

		proline / hydroxyproline}	

Question number	Answer	Additional guidance	Mark
2(b)(i)	• tangent drawn correctly at 30 mins (1) • rate given (1)	**ACCEPT** straight line outside of curve at 30 mins **ACCEPT** in the range of 2 to 3.158 up to 3 dps Bald answer within the range = 2 marks Bald answer with too many dps = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation that includes three of the following points: • <u>active site</u> (of protease) {binds to / fits} the {elastin / substrate} (1) • activation energy lowered (by the protease) (1) • breaking the <u>peptide</u> bonds (1) • by hydrolysis (1)	**ACCEPT** forms an enzyme-substrate complex **DO NOT ACCEPT** other named bonds dipeptide / polypeptide bonds	**(3)**

Question number	Answer	Additional guidance	Mark
3(a)	An explanation that includes three of the following points: • because people with cystic fibrosis produce {thick / sticky} mucus (1) • which reduces the air {into / out of} the lungs (1) • so FEV_1 will improve if the treatment is working (1) • a mean is used to increase the validity of the {data / results} (1) • a mean as different people have different FEV_1 (1)	**ACCEPT** {blocks / narrows] the airways / builds up in the lungs **ACCEPT** converse	**(3)**

Question number	Answer	Additional guidance	Mark
3(b)	An explanation that includes two of the following points: • because the investigation does not show the results for the individual drugs (1) • so, no comparison can be made (between the effect of the combination drug and the individual drugs) (1)	**ACCEPT** the drugs on their own were not tested only the results for the combination are shown	**(2)**

	• no indication of the nature of the control (1)		

Question number	Answer	Additional guidance	Mark
3(c)	An answer that includes two of the following points: • because cystic fibrosis is caused by a number of different mutations (1) • and, therefore, affect the CFTR protein in different ways (1) • and different organs will be affected (1) **OR** different drugs may treat different symptoms (1)	**DO NOT ACCEPT** treat different mutations	**(2)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	The correct answer is **D** ***A** is incorrect because the vena cava carries blood to the heart, has valves along its length and has an endothelial lining* ***B** is incorrect because the vena cava carries blood to the heart, has valves along its length and has an endothelial lining* ***C** A is incorrect because the vena cava carries blood to the heart, has valves along its length and has an endothelial lining*		**(1)**

Question number	Answer	Additional guidance	Mark
4(a)(ii)	The correct answer is **C** ***A** is incorrect because the direction of flow of blood away from the heart classifies a blood vessel as an artery* ***B** is incorrect because the direction of flow of blood away from the heart classifies a blood vessel as an artery* ***D** is incorrect because arteries carry blood away from the heart not towards it.*		**(1)**

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

Question number	Answer	Additional guidance	Mark
4(a)(iv)	The correct answer is **A** ***B*** *is incorrect because the valve T is the bicuspid valve and is open during both atrial systole and diastole* ***C*** *is incorrect because the valve T is the bicuspid valve and is open during both atrial systole and diastole* ***D*** *is incorrect because the valve T is the bicuspid valve and is open during both atrial systole and diastole*		**(1)**

Question number	Answer	Additional guidance	Mark
4(b)(i)	• 32 (beats min^{-1})		**(1)**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	• 0.5 / 0.54 / 0.541 (seconds)		**(1)**

Question number	Answer	Additional guidance	Mark
4(b)(iii)	An answer that includes three of the following points: • atropine increases heart rate and propranolol decreases heart rate (1) • atropine increases heart rate whether given first or second (1) **OR** propranolol decrease heart rate whether given first or second (1) • either regimen results in {same / similar} (overall) heart rate (1) • credit suitable comment about error bars (1)	**ACCEPT** propranolol decreases heart rate more when added after atropine **ACCEPT** order of drugs makes {little / no difference} overall both groups ended up the same e.g. these results are significant as error bars do not overlap (except in last two days) error bars are close together so drugs are having similar effects error bars for atropine (in first part) are wider so more uncertainty	**(3)**

Question number	Answer	Additional guidance	Mark
5(a)(i)	The correct answer is **C** ***A** is incorrect because high cholesterol would increase the risk* ***B** is incorrect because high cholesterol would increase the risk* ***D** is incorrect because high antioxidants help reduce the risk*		**(1)**

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An answer that includes two of the following points: • salt • fibre • energy (content) • saturated fats • alcohol	**NB** two correct answers needed for 1 mark	**(1)**

Question number	Answer	Additional guidance	Mark
5(b)(i)	• investigation may not be valid / lifestyle can affect the risk (of CVD) (1)	**ACCEPT** named lifestyle	**(1)**

Question number	Answer	Additional guidance	Mark
5(b)(ii)	An answer that includes two of the following points: • they did not want to admit to how much energy they consumed (1) • they had not kept a record of the food that they had eaten (1) • they did not know the energy content of the different foods that they were eating **OR** they did not know {how to do it / that they could do it} (1)	**ACCEPT** embarrassed about how much they consumed they knew they consumed too {little / much} energy **ACCEPT** they did not know how much food they had eaten **ACCEPT** information not available nutritional content **ACCEPT** they guessed, if neither mp 2 nor 3 awarded	**(2)**

Question number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation that includes two of the following points: • because the investigation was looking at the effect of this diet on the of CVD (1) • and these women were already (as they were developing the disease) (1) • therefore, the {investigation / data / conclusion} would not be valid (1)	**ACCEPT** more likely	**(2)**

Question number	Answer	Additional guidance	Mark
5(b)(iv)	• 24 / 23.8 / 23.78 / 23.780 (%) (1)		**(1)**

Question number	Answer	Additional guidance	Mark
5(c)	An explanation that includes three of the following points: • because this results in less cholesterol (in diet / in blood) (1) • therefore {no / less} {plaque / atheroma / blood clot} (1) • to {block / narrow} the coronary artery (1) • therefore, blood will be able to continue flowing to the {heart / cardiac} {cells / tissue / muscle} (1)	**ACCEPT** less LDL / lower LDL : HDL	**(3)**

Question number	Answer	Additional guidance	Mark
6(a)(i)	The correct answer is **B** ***A** is incorrect because the head is a phosphate and the tails are fatty acids* ***C** is incorrect because the head is a phosphate and the tails are fatty acids* ***D** is incorrect because the heads are hydrophilic and the tails are hydrophobic*		**(1)**

Question number	Answer	Additional guidance	Mark
6(a)(ii)	An answer that includes four of the following points: Similarities: • both have proteins (1) • both have {phospholipid / phospholipid bilayer} (1) Differences: • FMM has proteins {embedded / intrinsic}, but DDM has proteins {outside / in a layer/ extrinsic} (1) • FMM has cholesterol but DDM does not (1) • FMM has {glycoproteins / glycolipids} but DDM does not (1)	**DO NOT PIECE TOGETHER FROM TWO DESCRIPTIONS** **ACCEPT** description of embedded proteins e.g. channel proteins DDM proteins are not embedded	**(4)**

Question number	Answer	Additional guidance	Mark
6(b)(i)	An answer that includes two of the following points: • there could be (uncontrolled) movement of {substances / named substances} (into / out of cell) (1) • cell cannot maintain concentration gradients of substances (1) • credit consequence of this (1) • loss of cell {recognition / adhesion} / loss of membrane-embedded molecules (1)	**ACCEPT** cytoplasm could leak out molecules will not be able to pass through {active transport / facilitated diffusion} could not take place bacteria / organelles **ACCEPT** {solute / water / osmotic} potential e.g. cannot maintain ATP levels, cell could {shrivel up / burst}, no oxygen for (aerobic) respiration	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation that includes the following points: • because the phospholipids (and proteins) {can move / are fluid} (within the membrane) (1) • therefore {phospholipids / fatty acids} can interact (hydrophobically) (1)	**ACCEPT** bond Van der Waals forces / London forces / hydrophobic interactions vesicles fusing with membrane (by exocytosis / endocytosis)	**(2)**

Question number	Answer	Additional guidance	Mark
6(b)(iii)	An answer that includes two of the following points: • more {membrane / phospholipid / protein / glycoprotein / glycolipid / cholesterol} needs to be made (1) • membrane needs restructuring / proteins added to membrane (1) • increase rate of {respiration / ATP synthesis / release of energy} (1)	**ACCEPT** {channel / carrier} proteins **ACCEPT** {cholesterol / glycolipids / glycoproteins} need to move into place	**(2)**

Question number	Answer	Additional guidance	Mark
7(a)	A description that includes the following points: • one glycerol and three fatty acids (1) • (joined together by) ester {bonds / links / groups} (1)	**ACCEPT** joined by esterification	(2)

Question number	Answer	Additional guidance	Mark
7(b)	An explanation that includes three of the following points: • because large lungs would have a large volume of air {in the alveoli / taken in} (1) • because there would be {more alveoli for gas exchange / large surface area for more gas exchange / larger surface area for gas exchange} (1) • because large heart could pump more blood (1) • therefore supplying cells with sufficient oxygen (1)	**ACCEPT** more oxygen to enter **ACCEPT** diffusion of {gases / oxygen / carbon dioxide} **ACCEPT** pump at higher pressure more warm blood **ACCEPT** (more warm blood) to maintain body temperature	**(3)**

Question number	Answer	Additional guidance	Mark
7(c)(i)	• 4.3×10^{-11}	**ACCEPT** 4.30×10^{-11}	**(1)**

Question number	Answer	Additional guidance	Mark
7(c)(ii)	• volume of sphere calculated (1) • 1 : 3 / 1 : 2.7 / 1 : 2.67 (1)	2048 2 144.66058450 **ACCEPT** 1 : 3 / 1 : 2.8 / 1 : 2.79 ecf 1 : 21 / 1 : 21.3 / 1 : 21.33 (if 16 used) 1 : 22 / 1 : 22.3 / 1 : 22.34 (if 16 used) Bald answer of 1 : 3 / 1 : 2.7 / 1 : 2.8 / 1 : 2.67 / 1 : 2.79 = 2 marks 1 : 21 / 1 : 21.3 / 1 : 21.33 / 1 : 22 / 1 : 22.3 / 1 : 22.34 / 2048 / 2 144.66 = 1 mark	**(2)**

Question number	Answer	Mark
*7(c)(iii)	Indicative content: **High concentration of red blood cells:** • therefore, they carry high levels of oxygen • to the tissues for (aerobic) respiration • so can meet the oxygen demands of the yaks **Small red blood cells:** • therefore, the surface area to volume ratio is high • so oxygen can diffuse into the cells faster • although each red blood cell probably carries less oxygen • but this will be compensated by the large number of cells • smaller red blood cells pack closer together than larger ones / more cells in small volume of blood **High concentration of haemoglobin:** • therefore, high levels of oxygen can be carried • as each red blood cell can carry more oxygen • as each haemoglobin molecule can bind to 4 oxygen molecules **Fetal haemoglobin:** • which has a higher affinity for oxygen • therefore, the haemoglobin can bind the oxygen even in low partial pressures • and therefore carry more oxygen / have a higher percentage saturation of haemoglobin with oxygen	**(6)**

			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.	Simple links made between characteristics of blood and altitude 1 mark = one comment about one characteristic 2 marks = one comment made about two characteristics
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 characteristics of blood and altitude 3 marks = one comment made about three characteristics 4 marks = extended comments about one characteristic + a comment about one other characteristic
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.	Clear discussions on all aspects of blood and altitude 5 marks = extended comments about two characteristics + a comment on the other two characteristic 6 marks = extended comments about three aspects + a comment on the other characteristic

Question number	Answer	Additional guidance	Mark
8(a)	An explanation that includes the following points: • because the {phenotype / blood group} of individual 3 is {different / combination} from that of individual 1 and 2 (1) • because neither of the alleles are dominant / both alleles are expressed (1)	**ACCEPT** the phenotype of the heterozygote is different from the phenotype of either homozygote MM gives you blood group M + NN gives you blood group N but MN gives you a different blood group offspring have both the blood types (in their phenotype) **ACCEPT** both alleles are equal / equally dominant	**(2)**

Question number	Answer	Additional guidance	Mark
8(b)	An answer that includes the following points: • genotypes of individuals 3 and 4 shown / alleles in gametes of individuals 3 and 4 shown (1) • possible genotypes of children shown (1) • corresponding phenotypes given (1) • 1 type M : 1 type N : 2 type MN (1)	genotypes : MN / MN gametes : M or N / M or N MM and NN and 2 × MN MM = blood group M and NN = blood group N and MN = blood group MN **DO NOT ACCEPT** blood group MM / NN **ACCEPT** in any order provided it is clear which phenotype each number relates to	**(4)**

Question number	Answer	Additional guidance	Mark
8(c)(i)	An explanation that includes three of the following points: • individual 3 will have both (M and N) proteins (on the surface the of the red blood cells) (1) • because individual 3 will {be heterozygous / have one allele for M and one allele for N / have the genotype MN} (1) • (both) genes will be transcribed / mRNA produced for (both) genes (1) • and translated (1)	**ACCEPT** one gene for M and one gene for N **ACCEPT** {alleles / DNA} will be transcribed	**(3)**

Question number	Answer	Mark
*8(c)(ii)	**Substitution mutation:** • substitution swaps one base for another • may not alter the amino acid coded for • as the genetic code is degenerate • triplet codon codes for the same amino acid • therefore, no effect on the protein • therefore, no effect on the phenotype • amino acid could be different • therefore, shape of protein may or may not be (significantly) different • depending on significance the phenotype may stay the same • depending on the significance the phenotype may become the same as one of the parents • a stop codon could be coded for • so the protein may be {shorter / not coded for} • so the phenotype may become the same as one of the parents **Insertion / deletion mutation:** • deletion removes one base • insertion adds in a base • causing a frameshift • this will probably have a huge effect on protein • phenotype may become one of parents • may have little effect on protein if near the end of the gene sequence • and therefore, have very little effect on phenotype	**(6)**

			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.	Simple links made between mutation and effect on protein or phenotype 1 mark = one comment 2 marks = three comments
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 between mutation and effect on protein or effect on phenotype in the context of the question 3 marks = extended comments about one effect of one type of mutation 4 marks = extended comments about one effect of two types of mutations OR extended comments about two effects of one mutation
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.	Clear discussions on all aspects of mutations and effect on protein and effect on phenotype in the context of the question 5 marks = extended comments about one effect of one type of mutation 6 marks = extended comments about one effect of two types of mutations OR extended comments about two effects of one mutation

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