Mark Scheme (Results)

January 2022

Pearson Edexcel International Advanced 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)	The correct answer is **C** ***A*** *is incorrect because starch is insoluble in water and consists of amylose and amylopectin is insoluble in water* ***B*** *is incorrect because starch is insoluble in water and consists of amylose and amylopectin is insoluble in water* ***D*** *is incorrect because starch has 1-4 bonds as well as 1-6*		**(1)**

Question number	Answer	Additional guidance	Mark
1(b)(i)	An answer that includes the following points: • glycosidic (1) • (α) glucose (1) • fructose (1) • galactose (1)	 **IGNORE** 1-4 / 1-6 **IGNORE** α and β **IGNORE** α and β	**(4)**

Question number	Answer	Additional guidance	Mark
1(b)(ii)	• condensation (reaction) (1)	**ACCEPT** polymerisation	**(1)**

Question number	Answer	Additional guidance	Mark
1(b)(iii)	The correct answer is **C** ***A*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342* ***B*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342* ***D*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342*		**(1)**

Question number	Answer	Additional guidance	Mark
2(a)(i)	The correct answer is **B** ***A*** *is incorrect because the aorta takes blood away from the left hand side of the heart* ***C*** *is incorrect because pulmonary vein returns blood to the left hand side of the heart* ***D*** *is incorrect because the vena cava returns blood to the right atrium*		**(1)**

Question number	Answer	Additional guidance	Mark
2(a)(ii)	The correct answer is **A** ***B*** *is incorrect because stage F which is ventricular systole* ***C*** *is incorrect because* ***F*** *is ventricular systole* ***D*** *is incorrect because* ***F*** *is ventricular systole*		**(1)**

Question number	Answer	Additional guidance	Mark
2(b)(i)	• values read from the graph and subtracted to give the time for one heart beat (1) • 75.0 (1)	0.8 / any pair of values that give 0.8 when subtracted **DO NOT ACCEPT** 75 ECF from mp 1 if values correspond to readings from graph Bald answer of 75.0 = 2 marks Bald answer of 75 = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An answer that includes three of the following points: • graph will be {the same / similar in} {shape / position} (1) • because the left hand side and right hand side beat simultaneously (1) • peaks will be lower (1) • because pressure in right hand side is lower {as blood is only pumped to <u>lungs</u> / to prevent damage to <u>alveoli</u>} (1)	**NB** 'It' refers to the line for the right ventricle **NB** accept converse where appropriate **ACCEPT** line **ACCEPT** description e.g. both ventricles contract at the same time **IGNORE** graph lower down **ACCEPT** because right ventricle has {less muscle / thinner walls} as blood is only pumped to <u>lungs</u> less force to <u>lungs</u> **NB If candidate says that there is something drawn on the graph you must send it to review**	**(3)**

Question number	Answer	Additional guidance	Mark
3(a)	A description that includes the following points: • contain {deoxyribose / pentose / 5 carbon sugar}, phosphate and bases (1) • (mononucleotides / bases) held together by hydrogen bonds (1) • between {complementary bases / named example} (1)	**NB** ignore statements clearly relating to RNA **ACCEPT** pair contains purine and pyrimidine / (mono)nucleotide contains either purine or pyrimidine phosphate group / PO_4^{3-} **DO NOT ACCEPT** P / Pi / wrong formulae **IGNORE** stated number of H bonds **ACCEPT** A / T / C / G **IGNORE** descriptions of mononucleotides joined by phosphodiester bonds in a strand **NB** points can be awarded from clearly labelled diagrams	**(3)**

Question number	Answer	Additional guidance	Mark
3(b)	• number of seconds for molecules to replicate calculated (1) • 833 (1) **OR** • number of molecules replicated in 1 hour (1) • 833 (1)	(150 million ÷ 50) 3 000 000 (50 × 60 × 60 =) 180 000 Bald answer of 833 = 2 marks Bald answer of 833.3 = 1 mark unless given as a recurring number	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(i)	An explanation that includes the following points: • bind to each strand of the DNA (to initiate replication) (1) • credit function of DNA polymerase (1) • so that the DNA can be synthesised in both directions (1)	**ACCEPT** works at both ends of the bubble **IGNORE** ref to 3' / 5' **e.g.** lines up nucleotides (along each strand) forms phosphodiester bonds (between adjacent nucleotides) repairs mistakes in replication **IGNORE** forms hydrogen bonds between nucleotides	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)(ii)	An answer that includes the following points: • to speed up the process (of DNA synthesis) (1) • so that S phase {is shorter / lasts 8 hours and not 833 hours} (1) • so that cell division is fast enough (1)	**ACCEPT** wrong figures implied from a wrong calculation	**(3)**

Question number	Answer	Additional guidance	Mark
4(a)	• the {length of DNA / sequence of (DNA) bases} that code for {amino acids / (poly)peptide / protein} (1)	**ACCEPT** nucleotides for bases primary structure of protein	**(1)**

Question number	Answer	Additional guidance	Mark
4(b)	An explanation that includes the following points:		
	• because the mutation is in the gene coding for the CFTR (protein) (1)	**ACCEPT** mutation in CFTR gene	
	• therefore the CFTR (protein) does not function correctly (1)	**ACCEPT** change in structure	
	• credit details of dysfunction (resulting in very thick sticky mucus) (1)	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	
	• therefore the mucus will be (very) {thick / sticky} (1)		**(3)**

Question number	Answer	Additional guidance	Mark
4(c)	An answer that includes three of the following points: • couples (both) carrying one copy of the mutation can be identified (1) • they can then make (an informed) {decision / choice} (about having a child) (1) • credit an example of their options (1) • resulting in fewer babies being born who are homozygous (1)	**ACCEPT** couples who are (both) heterozygous / have a CF allele **DO NOT ACCEPT** choose which embryos to implant e.g not having a child / adoption / IVF **DO NOT ACCEPT** have an abortion **ACCEPT** two copies of the mutation fewer heterozygous babies born	**(3)**

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

Question number	Answer	Additional guidance	Mark
5(a)(ii)	An explanation that includes the following points: • gives (the wall) (tensile) strength (1) • so that the aorta {does not get damaged by / can withstand} pressure (of the blood leaving the heart) (1)	**IGNORE** refs to elastic properties and recoil **IGNORE** prevents aorta from collapsing	**(2)**

Question number	Answer	Additional guidance	Mark
*5(b)	Indicative content: Graph 1 • older male monkeys have more stiffness than younger males (D) • older female monkeys have more stiffness than younger females (D) • older males have more stiffness than older females (D) • probably significant as error bars do not overlap (C) • not much difference in stiffness between younger males and females (D) • as error bars overlap (C) • age increases aortic stiffness in both males and females (C) • age has a greater effect on aortic stiffness in males than females (C) Graph 2 • density of collagen decreases slightly with age (D) • males of all ages have (slightly) more collagen that females (C) • probably not significant as error bars overlap (C) • neither age nor sex affects density of collagen (C) • changes in stiffness do not appear to be related to the density of collagen (C) Graph 3 • higher type 1 in younger monkeys than older ones (D) • more type 1 in females than males at each age (D) • no error bars shown to judge significance (C) Graph 4 • more type 8 in older male monkeys (D) • may not be a difference in type 8 between older and younger females (D) • no error bars to judge significance (C) • the type of collagen appears to determine stiffness (C) • stiffness associated with decrease in type 1 and increase in type 8 (C*)	**Level 1** 1 mark = description made from one graph (D) 2 marks = descriptions made from two graphs (D) **Level 2** 3 marks = plus one conclusion made (C) 4 marks = plus two conclusions made (C) **Level 3** 5 marks = two conclusions and comments on the other two graphs 6 marks = three conclusions that includes the asterisked conclusion (C*) and comments on the other two graphs **Description = comparison of one variable** **Conclusion = summary statement that includes both age and sex** **interpretation of error bar and significance of data – not reliability** **links between 2 graphs**	**(6)**

Question number	Answer	Mark
6(a)(i)	The only correct answer is **D** ***A*** *is incorrect because diffusion does not use proteins* ***B*** *is incorrect because diffusion does not use proteins* ***C*** *is incorrect because diffusion does not use proteins*	**(1)**

Question number	Answer	Mark
6(a)(ii)	The only correct answer is **B** ***A*** *is incorrect because diffusion does not use energy* ***C*** *is incorrect because facilitated diffusion does not use energy* ***D*** *is incorrect because facilitated diffusion does not use energy*	**(1)**

Question number	Answer	Mark
6(a)(iii)	The only correct answer is **B** ***A*** *is incorrect because solutes can move against their concentration gradient in active transport* ***C*** *is incorrect because solutes can move against their concentration gradient in active transport* ***D*** *is incorrect because solutes can move against their concentration gradient in active transport*	**(1)**

Question number	Answer	Additional guidance	Mark
6(b)	An explanation that includes the following points: • (free water molecules) because some water molecules are {restricted / prevented} from movement (1) • (partially permeable membrane} because membrane allows some (types of) molecules to pass through it (1) • (down a water potential gradient) because water molecules move {from a dilute solution to a more concentrated one / from a high osmotic potential to a lower one / from a high solute potential to a lower one} (1)	**ACCEPT** a description **ACCEPT** from a low concentration of solute to a high concentration of solute from hypotonic to hypertonic solution **IGNORE** from a high water concentration to a lower one	**(3)**

Question number	Answer	Additional guidance	Mark
*6(c)	Indicative content: • water content decreases when crabs first moved (D) • because water passes out of cells by {osmosis / description of osmosis} (E) • water content then increases gradually (D) • because of the increase in amino acid concentration (E) • amino acid increases (D) • sharply at first and then rate decreases (D) • because {insoluble / muscle} proteins broken down into amino acids (E) • by hydrolysis (E) • because crab eats more {protein / amino acids} (E) • which is digested into amino acids (E) • which are taken up into the cells by {active transport / facilitated diffusion} (from the blood) (E) • water content increases because the amino acid content increase (E) • which makes the cytoplasm more concentrated than the sea water (E) • therefore crabs do not die from dehydration (E)	**Level 1** **1 mark** = simple description of one graph **2 marks** = simple description of both graphs **Level 2** **3 marks** = and a simple explanation of one graph **4 marks** = and a simple explanation of both graphs **Level 3** **5 marks** = a simple explanation of one graph and a more detailed explanation for the other graph **6 marks** = a more detailed explanation for both graphs	**(6)**

Question number	Answer	Mark
7(a)(i)	The only correct answer is **A** ***B*** *is incorrect because a person can modify their alcohol intake* ***C*** *is incorrect because a person can modify their blood pressure* ***D*** *is incorrect because a person can change their level of activity*	**(1)**

Question number	Answer	Additional guidance	Mark
7(a)(ii)	An explanation that includes the following points: • because many factors cause CVD (1) • different drugs treat different conditions (1)	**ACCEPT** two named drugs and what they treat **IGNORE** wrong drugs	**(2)**

Question number	Answer	Additional guidance	Mark
7(b)(i)	An explanation that includes the following points: • because antioxidants reduce free radicals (1) • therefore {cell damage / damage to lining of blood vessels / oxidative stress} will be reduced (1) • therefore reducing {plaque / atheroma} formation (due to decreased free radicals) (1)	**ACCEPT** neutralise / donate electrons to / break down / stabilise **IGNORE** incorrect consequences	**(3)**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation that includes the following points: • {study / data} will not be valid (1) • diet has an impact on CVD (1) • credit an example explained (1)	**IGNORE** non-dietary factors **IGNORE** reliability / accuracy **ACCEPT** {increase risk / decrease risk} in correct context e.g. high salt causes high blood pressure high fibre reduces cholesterol absorption	**(3)**

Question number	Answer	Additional guidance	Mark
7(b)(iii)	An explanation that includes the following points: • because diet affects a number of risk factors (1) • credit example of change in diet and the risk factor it reduces (1) • credit a second example of change in diet and the risk factor it reduces (1)	**IGNORE** non-dietary examples e.g. salt intake can be reduced to lower blood pressure {saturated / animal} fats can be reduced to reduce {cholesterol levels / atheroma formation} unsaturated fats can be increased to reduce {cholesterol levels / atheroma formation}	**(2)**

Question number	Answer	Additional guidance	Mark
8(a)(i)	• GUG	**ACCEPT** guanine uracil guanine / CAC / cytosine adenine cytosine **IGNORE** val / valine	**(1)**

Question number	Answer	Additional guidance	Mark
8(a)(ii)	• substitution	**DO NOT ACCEPT** frameshift / deletion / addition / insertion **IGNORE** {gene / point} mutation	**(1)**

Question number	Answer	Additional guidance	Mark
8(a)(iii)	An answer that includes the following points: • the R groups (of these two amino acids) have different {properties / bonding} (1) • glu may have repelled polar groups on other haemoglobin molecules (1) • {val / hydrophobic R group / hydrophobic part} might form other (hydrophobic) interactions (with other haemoglobin molecules) (1) • (part of haemoglobin containing) val (R group) turns away from {water / cytoplasm} (1)	**ACCEPT** amino acids have different properties **ACCEPT** bonds / Van der Waals **DO NOT ACCEPT** incorrect named bonds **ACCEPT** repels water **DO NOT ACCEPT** blood / plasma	**(3)**

Question number	Answer	Additional guidance	Mark
8(b)	• number of non-affected babies calculated (1) • 0.002 : 1 / 2 × 10^{-3} : 1 (1)	(140 million - 305 800 =) 139 694 200 0.002189 **ACCEPT** 0.0022 / 0.00219 / 0.002189 **ACCEPT** 1 : 457 / 456.8 **NB** 1 mark for 1 : 458 / 1 : 457.8 0.002184 : 1 (0.002 / 0.0022 / 0.0218) Bald answer = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
8(c)(i)	• values read correctly from the graph (1) • 3.3 / 3.4 (1)	**ACCEPT** 4.4 / 4.9 and 5.7 / 5.8 / 7.7 / 7.8 **ACCEPT** ecf for correct subtraction using {4.4 / 7.7 / 7.8} and one incorrect value Bald answer = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
8(c)(ii)	An answer that includes the following points: • person without the disease has higher saturation than person with the disease (at all partial pressures of oxygen) (1) • there is {greater variability / wider range} (in the saturation) of a person with the disease than a person without the disease (at a particular partial pressure of oxygen) (1)	**NB** accept converse throughout but all conclusions must be comparative **ACCEPT** refs to affinity (for oxygen) **IGNORE** graph shifted	**(2)**

Question number	Answer	Additional guidance	Mark
8(c)(iii)	• 120 (days) (1)		**(1)**

Question number	Answer	Additional guidance	Mark
8(c)(iv)	An explanation that includes three of the following points: • (change in structure of haemoglobin) haemoglobin {binds / carries} less oxygen (1) • (shape of red blood cell) smaller surface area so less oxygen <u>diffuses</u> in / red blood cells get lodged in blood vessels preventing flow of blood to cells (1) • therefore less oxygen to {cells / tissues} so {less available for (aerobic) <u>respiration</u> / switch to <u>anaerobic respiration</u>} (1) • credit an example of why less oxygen to cells could be fatal (1)	**NB** accept converse where appropriate **ACCEPT** named cell / tissue e.g. heart attack, stroke, sepsis, infection	**(3)**

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