Mark Scheme (Results)

October 2024

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

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

October 2024
Question Paper Log Number P78384A
Publications Code WBI11_01_2410_MS

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 membrane is) fluid / fluidity (1)	**ACCEPT** the phospholipids (and proteins) can move (within the membrane) **IGNORE** flexible / fluid mosaic model / semipermeable / mosaic / bilayer	**(1)**

Question number	Answer	Mark
1(b)(i)	The correct answer is **A** ***B*** *is incorrect because the units are* μm^2 ***C*** *is incorrect because the radius is 150 not 300* ***D*** *is incorrect because the radius is 150 and not 300 and the units are* μm^2	**(1)**

Question number	Answer	Mark
1(b)(ii)	The correct answer is **C** ***A*** *is incorrect because the surface area will increase not decrease* ***B*** *is incorrect because the volume will stay the same* ***D*** *is incorrect because surface area will increase not stay the same*	**(1)**

Question number	Answer	Additional guidance	Mark
1(b)(iii)	An explanation that includes two of the following points: • because there is a higher concentration (of oxygen) {outside / in the water} (than in the cytoplasm) (1) • because {all parts of the amoeba are close to the cell membrane / amoeba has a small volume / because it has a large surface area (to volume ratio)} 1) • low energy requirements / low metabolism / low respiratory rate (1)	**ACCEPT** converse for cytoplasm compared to water **ACCEPT** partial pressure **ACCEPT** amoeba is small / diffusion distance is small (to all parts of cell)	**(2)**

Question number	Answer	Additional guidance	Mark
2(a)	• 1.431×10^{15} / 1.43×10^{15} / 1.4×10^{15} (1)	**ACCEPT** $1.431 \cdot 10^{15}$ / $1.43 \cdot 10^{15}$ / $1.4 \cdot 10^{15}$	**(1)**

Question number	Answer	Mark
2(b)	The correct answer is **D** ***A*** *is incorrect because haemoglobin is not fibrous, it is globular* ***B*** *is incorrect because haemoglobin has quaternary structure* ***C*** *is incorrect because haemoglobin is not fibrous*	**(1)**

Question number	Answer	Additional guidance	Mark
2(c)(i)	A description that includes the following points: • embryonic development: α, β and γ subunits increase (1) • fetal development: constant levels of α, (constant levels and then) increase presence β, (short increase and then decreases) decreasing presence of γ (1) • baby: presence of α remains the same, increased presence of β (which levels off), decrease in γ (and then levels off) (1) **OR** • α subunit increases during embryonic development and then remain constant (1) • β subunit increases throughout embryonic and fetal development and in the baby (and then levels off) (1) • Y subunit increases during embryonic development and then falls during fetal development and in the baby (and then levels off) (1)	**DO NOT** piece together or mix mps from both sets **ACCEPT** answers in weeks not stages throughout provided correct values are quoted and fall within: embryonic : up to 8 fetal : between 8 and 39 / 40 baby : between 0 and 42 **ACCEPT** increases and then at birth increases and levels off	**(3)**

Question number	Answer	Additional guidance	Mark
2(c)(ii)	An explanation that includes the following points: • fetal haemoglobin has higher affinity (than adult) (1) • so that oxygen will leave the adult haemoglobin and bind to fetal haemoglobin (1) • at the same partial pressure of oxygen (1)	**Penalise baby for fetus once** **ACCEPT** converse **ACCEPT** stronger {binding / association} (with oxygen) Y globin has higher affinity than β globin **IGNORE** easier / better / faster **ACCEPT** so oxygen will pass from mother's blood into fetus' blood so that the fetal haemoglobin will be more saturated (with oxygen than the adult) **ACCEPT** same oxygen concentration	**(2)**

Question number	Answer	Mark
3(a)(i)	The correct answer is **B** ***A** is incorrect because individual 1 is not homozygous* ***C** is incorrect because genotype and phenotype are the wrong way round* ***D** is incorrect because genotype and phenotype are the wrong way round*	**(1)**

Question number	Answer	Mark
3(a)(ii)	The correct answer is **D** *A is incorrect because individual 3 is not affected but his parents are both carriers* *B is incorrect because individual 3 is not affected but his parents are both carriers* *C is incorrect because individual 3 is not affected but his parents are both carriers*	**(1)**

Question number	Answer	Mark
3(a)(iii)	The correct answer is **C** *A is incorrect because 1 in 4 CMT × 1 in 2 female = 1 in 8* *B is incorrect because 1 in 4 CMT × 1 in 2 female = 1 in 8* *D is incorrect because 1 in 4 CMT × 1 in 2 female = 1 in 8*	**(1)**

Question number	Answer	Additional guidance	Mark
3(b)(i)	• 6 300 / 6.3×10^3 (1)	**ACCEPT** $6.3 \cdot 10^3$	**(1)**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer that includes the following points: • the {genotype / alleles present in the gametes} of parents shown (1) • possible genotypes of children shown (1) • tt is unaffected and Tt has CMT (1)	(Parent 1) (Parent 2) tt Tt T or t tt (tt) Tt (Tt) Not CMT/ no / x CMT / yes / ✓ **ACCEPT** from a pedigree diagram that shows the Ts and ts **NB** ECF if genotypes / gametes wrong for mp 1	**(3)**

Question number	Answer	Additional guidance	Mark
3(c)	An explanation that includes the following points: • male parent with CMT will have {X^c Y / X^T Y/ the CMT allele on the X chromosome (only) / no CMT allele on the Y chromosome} (1) • (only) the Y chromosome is passed onto their sons (1)	**ACCEPT** mutation (for CMT) on X chromosome CMT version of the gene faulty allele (for CMT) **IGNORE** CMT gene / CMT / the disease **ACCEPT** does not pass X chromosome on	**(2)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	The correct answer is **D** *A is incorrect because the correct answer is (2.5 × 10 × 1000)*/0.14 = *178 571.42857 = 179 000* *B is incorrect because the correct answer is (2.5 × 10 × 1000)*/0.14 = *178 571.42857 = 179 000* *C is incorrect because the correct answer is (2.5 × 10 × 1000)*/0.14 = *178 571.42857 = 179 000*		**(1)**

Question number	Answer	Additional guidance	Mark
4(a)(ii)	An explanation that includes three of the following points: • (wall of) aorta has {elastic fibres / (smooth) muscle / collagen} in it (1) • because the blood is under high pressure (from the heart) (1) • capillary (wall) is only one cell thick (1) • because this is where {gas exchange takes place (in the lungs) / plasma needs to pass (out) / tissue fluid needs to pass (in)} (1)	**ACCEPT** (elastic fibres) for (elastic) recoil / to squeeze / pumps blood along / maintains high blood pressure **ACCEPT** oxygen passes in / carbon dioxide passes out (in lungs)	**(3)**

Question number	Answer	Additional guidance	Mark
4(b)	An answer that includes the following points: • (duration of) (ventricular) diastole and (ventricular) systole decrease with increase in heart rate (1) • manipulation of figures to illustrate one change in duration (1)	**ACCEPT converse** **Piece together** e.g. ventricular diastole decreases by 0.39 seconds / 74% ventricular systole decreases by 0.11 second / 40%	**(2)**

Question number	Answer	Additional guidance	Mark
4(c)	An explanation that includes three of the following points: • (peak) rate of flow in forward direction decreases with distance from heart **OR** (peak) rate of flow in backward direction increases with distance from heart (1) • rate of flow decreases (with distance from heart) due to less {force / pressure} (1) • due to (increased) {resistance (between blood and vessel walls) / branching (of aorta) / friction (between blood and vessel walls)} (1) • some backflow of blood {corresponding with diastole / no valves in aorta} (1)	**ACCEPT** description of both atrioventricular and semilunar valves being open description of both atria and ventricles {being relaxed / having low pressure} elastic recoil	**(3)**

Question number	Answer	Additional guidance	Mark
5(a)	An explanation that includes the following points: • (safe / not too high a dose) to avoid {uncontrollable bleeding / named examples of uncontrollable bleeding / internal bleeding} (1) • (effective / not too low a dose) to reduce (the risk of) blood clotting (1)	**IGNORE** side effects / harm / toxicity **ACCEPT** passing blood in your urine passing blood in faeces or having black faeces severe bruising prolonged nosebleeds vomiting or coughing up blood heavy or increased bleeding during periods, or any other bleeding from the vagina jaundice **ACCEPT** thin the blood	**(2)**

Question number	Answer	Additional guidance	Mark
5(b)(i)	A description that includes the following points: • to carry a <u>copy</u> of the gene {out of the nucleus / into the cytoplasm / to the ribosomes} (1) • (used for) {(correct) ordering of the amino acids / producing amino acid sequence / formation of (poly)peptide chain} (1)	**ACCEPT** {(genetic) code / DNA base sequence / DNA} <u>if reference to the enzyme has been made</u> **NB** copy is the noun not the verb	**(2)**

Question number	Answer
*5(b)(ii)	(6) EXP

Advantages of pharmacogenomics:

- genotype {affects / determines} the dose of warfarin needed
- so one dose will not be appropriate for all patients
- as the two genes that have several alleles

- (one / two) gene M allele that slows down breakdown means less warfarin - accept converse for other alleles

- one gene V allele results in less enzyme V / mRNA so less warfarin should be prescribed – accept converse for other alleles

- other genetic predispositions maybe identified e.g. high cholesterol, high blood pressure

Effect of other factors:

- factors other than genotype affects blood clotting so these would need to be taken into account as well
- e.g. people with high cholesterol more likely to be prescribed warfarin
- mass of warfarin would need to be adjusted according to body size / given at a particular dose in mgs per kg
- liver function may affect the half life of the drug

Issues surrounding genetic screening:

- there are religious / moral / social / ethical issues relating to genetic screening
- people / family may not want to find out if there are any other underlying genetic issues
- possibility of false negative / positive results

Blood clotting:

- thromboplastin converts prothrombin into thrombin which converts fibrinogen into fibrin to trap platelets

			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 points made** 1 mark = 1 point made 2 marks = some attempt to comment on pharmacogenetics or factors that affect it OR description of blood clotting process
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.	**Simple discussion of pharmacogenetics** 3 marks = implications of genotype for either gene M or gene V on warfarin dose 4 marks = implications of genotype for both gene M and gene V on warfarin dose
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 other issues involved** 5 marks = criteria for 4 marks plus links made with either blood clotting process or other factors or issues of screening 6 marks = criteria for 4 marks plus links made with **two** from blood clotting process / other factors / issues surrounding screening

Question number	Answer	Additional guidance	Mark
6(a)	An explanation that includes three of the following points: • (less cholesterol) so reduces {build up of cholesterol / formation of atheroma / formation of a plaque} (1) • in the (walls of the) coronary artery (1) • so flow of blood to heart {muscle / cells / tissue} would not be prevented (1) • so oxygen available for respiration for heart {muscle / cells / tissue / contraction} (1)	**NB** Award converses but must be in context of less cholesterol for full marks to be awarded	**(3)**

Question number	Answer	Additional guidance	Mark
6(b)	Any **two** of the following:		

	• (total) number of amino acids (in a peptide) / length of {(poly)peptide / chain} • {sequence / order / position} of amino acids • {proportion / number} of each type of amino acids (1)	**ACCEPT** {sequence / order / position} R groups **ACCEPT** (types of) amino acids present R groups for amino acids	**(1)**

Question number	Answer	Additional guidance	Mark
6(c)(i)	An explanation that includes two of the following points: • because this (digestion) happens when a person eats soybeans / scientists wanted to mimic what was happening in the body (1) • to {extract / separate / release} the {proteins / glycinin and β-conglycinin / active ingredients} (1) • as enzymes needed to break (peptide) bonds (to produce the peptides) (1)	**ACCEPT** copies digestion **ACCEPT** so that the proteins are soluble	**(2)**

Question number	Answer	Additional guidance	Mark
6(c)(ii)	• because they (different enzymes) are {found in different parts of the digestive system / needed to break down different proteins} (1)	**ACCEPT** more than one type of enzyme in the body two or more named parts of digestive system different substrates	**(1)**

Question number	Answer	Additional guidance	Mark
6(c)(iii)	An explanation that includes the following points: • 37°C because this is the {optimum temperature (for human enzymes) / (human) body temperature} (1) • 2 hours because {this is enough time for complete digestion to occur / this is how long the digesting food stays in each part of the digestive system / this allows all the substrate to be broken down} (1)	**ACCEPT** time spent in stomach / (small) intestine sufficient time for enough peptides to be produced for the investigation	**(2)**

Question number	Answer	Additional guidance	Mark
6(d)	An explanation that includes three of the following points:		**(3)**

	• as the concentration of soybean peptides increase, the inhibition of HMGCR increases **and** the synthesis of cholesterol decreases (1) • because soybean peptides inhibit HMGCR • because the peptides {bind to the HMGCR / compete with the substrate} (1) • as the cholesterol precursor cannot be converted into cholesterol (by HMGCR) (1)	**NB** Piece together **ACCEPT** bind to the active site **ACCEPT** cholesterol precursor cannot bind to HMGCR	

Question number	Answer	Additional guidance	Mark
7(a)(i)	A description that includes the following points: • substitution mutations {swap / change / replaces} a {base / nucleotide} (1) • insertion and deletion mutations (results in a) change in the number of {bases / nucleotide} (1)	**ACCEPT** plural **ACCEPT** increases and decreases number of bases / greater or fewer number of bases / more or less bases changes length of {DNA / gene} / length of DNA gets longer or shorter **IGNORE** frameshift	**(2)**

Question number	Answer	Additional guidance	Mark
7(a)(ii)	An explanation that includes four of the following points: • substitution mutations will not affect protein function (1) • as substitution mutations may not alter the {amino acid / amino acid sequence} (1) • as the substitution mutation may occur in the non-coding region (of the DNA) (1) • substitution mutations may not affect protein function (1) • as substitution mutations may change one amino acid (only) (1)	**ACCEPT** {works / activity} for function **ACCEPT** may code for the same {amino acid / amino acid sequence} **ACCEPT** {works / activity} for function	**(4)**

	• {deletion / insertion} mutations may have (large) effects on protein function (1) • as {insertion / deletion} mutations cause a frameshift (1)	**ACCEPT** {works / activity} for function **ACCEPT** description of frameshift alters the sequence of amino acids after the mutation	

Question number	Answer	Additional guidance	Mark
7(a)(iii)	• mouse: more animals sampled (1)	**ACCEPT** easier to control variable **NB** answers about sample size must be comparative	**(1)**

Question number	Answer	Additional guidance	Mark
7(b)(i)	An answer that includes the following points: • an appropriate line of best fit (1) • whole number between 285 and 1143 (1)	straight line (reasonable if drawn by hand) does not extend further than the left hand or right hand points touches data for all 4 age groups	**(2)**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	A description that includes the following points: • number (of mutations) increases with age (in all four animals) (1) • different species have different life spans (1) • different species have different number of mutations (in their cells) (1) • different species have different {mutation rates / number of mutations per cell per year} (1) • humans have the greatest variation and naked mole rats have the least variation (in the number of mutations per cell) (1)	**ACCEPT** different species have different frequency of mutations	**(3)**

Question number	Answer	Additional guidance	Mark
7(b)(iii)	An answer that includes the following points: • cells divide at different {rates / frequencies} (1) • different {repair mechanisms / DNA polymerases} (1) • exposed to different {factors (that cause mutations) / environment} 1) • different {quantities of DNA / base sequences / genes} (1)	**ACCEPT** named example of a cell type **ACCEPT** named example e.g. UV **ACCEPT** alleles / chromosomes genetic predisposition / genetics	**(2)**

Question number	Answer	Additional guidance	Mark
8(a)	An answer that includes three of the following points, with at least one similarity and one difference: **Similarities:** • both contain carbon and hydrogen (and oxygen) (1) • both contain covalent bonds (only) (1) **Differences:** • unsaturated fatty acids contain carbon-carbon double bonds but saturated fatty acids have only single carbon-carbon double bonds (1)	**DO NOT PIECE TOGETHER** if in two separate descriptions. **ACCEPT** hydrocarbon chain / COOH group **DO NOT ACCEPT** ester bonds **ACCEPT** saturated fatty acids do not contain carbon-carbon double bond C = C and C - C **DO NOT ACCEPT** saturated fatty acids have no double bonds	**(3)**

	• unsaturated fatty acids have {fewer hydrogens (for same number of carbons) / lower hydrogen to carbon ratio / higher carbon to hydrogen ratio} (1) • unsaturated fatty acids are {kinked / bent} and saturated fatty acids are {straight / linear} (1)	**ACCEPT** converse for saturated fatty acids	

Question number	Answer	Additional guidance	Mark
8(b)(i)	The correct answer is **A** ***B** is incorrect because 41701 ÷ 68786 = 0.606242549355973, so ratio is 0.6 : 1* ***C** is incorrect because 41701 ÷ 68786 = 0.606242549355973, so ratio is 0.6 : 1* ***D** is incorrect because 41701 ÷ 68786 = 0.606242549355973, so ratio is 0.6 : 1*		**(1)**

Question number	Answer
*8(b)(ii)	**Animal products:** • how much animal products / fats / cholesterol / LDL / HDL do you consume in a week? • because cholesterol increase risk of atheroma • high HDL : LDL reduces risk of CVD • has your consumption of fatty acids decreased? • because this could reduce the risk without any avocados being eaten **Other dietary factors:** • how much {fibre / vegetables / fruit / cereal} do you consume each week? • because fibre reduces cholesterol levels • how much food containing antioxidants do you consume? • antioxidants reduce damage to endothelial cells • how much salt do you consume? • high salt intake is linked to high blood pressure • how much alcohol do you consume in a week? • alcohol affects liver function / increase blood pressure / affects the LDL:HDL ratio • is your calorie consumption greater than your energy usage? • obesity is a risk factor for CVD **Avocados:** • do you eat avocados every week? • did you have adverse reactions to the avocado? • because study needed to ensure that they were being eaten on a weekly basis • have you replaced animal products with avocados?

	• because part of the benefit of eating avocados is to reduce saturated fatty acids in diet • the effects of the diet need to be compared to previously • how many avocadoes do you eat each week? • to see if the number of avocadoes affect the results **Non-dietary questions:** • do you smoke / how many cigarettes do you smoke / do you have high blood pressure? • because smoking increases blood pressure / damages endothelial lining • do you have diabetes / family history / BMI / age? • these increase the likelihood of CVD

			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.	**Questions suggested, relating to non-diet CVD risk factors with some justification** 1 mark = 1 question suggested 2 marks = 1 question suggested which does not relate to diet with justification
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.	**Questions suggested that relate to diet with justification** 3 marks = 1 question which relate to diet justified 4 marks = 2 questions which relate to diet justified
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.	**Questions appropriate to this investigation with justifications** 5 marks = 3 questions which relate to diet with justification justifications 6 marks = 4 questions which relate to diet with justifications

Question number	Answer	Additional guidance	Mark
8(b)(iii)	An answer that includes at least one reason for it being valid and one reason for it not being valid for full marks to be awarded: Valid because : • large sample size (1) • represents both {men and women / a range of ages} (1) • ran for {a long period of time / 30 years} (1) • participants had no signs of CVD or stroke (1) Invalid because : • no control group (1)	**NB** must state if the reason makes it valid or not **ACCEPT** converse idea for invalid **IGNORE** number of men and women were different **ACCEPT** longitudinal study **IGNORE** healthy	**(4)**

	• no indication that {lifestyles are similar / there were no (other) underlying diseases} (1) • {diets / number of avocados} not controlled (1) • responses to questionnaire {are subjective / may not be truthful} (1)	**ACCEPT** named lifestyle lifestyles not controlled other factors that increase risk of CVD difficult to control **ACCEPT** frequency of questionnaire is low / questionnaire is every 4 years	

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom