Mark Scheme (Results)

January 2021

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

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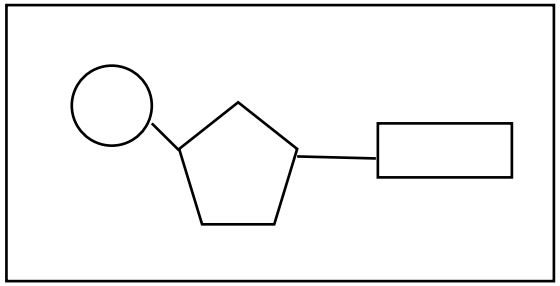
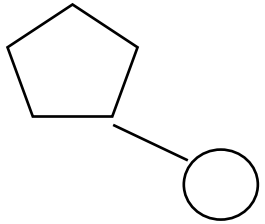
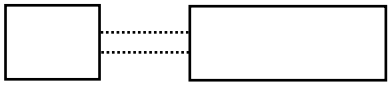
General Marking Guidance

- 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	Mark
1(a)(i)	**B**  ***A*** *is incorrect because the phosphate should be joined to C4* ***C*** *is incorrect because the base should be attached to C1* ***D*** *is incorrect because the phosphate should be joined to C4 and the base should be attached to C1*	**(1)**

Question number	Answer	Mark
1(a)(ii)	**B**  ***A*** *is incorrect because a phosphate is attached to the sugar not the base* ***C*** *is incorrect because a phosphodiester joins a sugar with a phosphate, not two phosphates* ***DC*** *is incorrect because the phosphate is joined to the sugar not the base*	**(1)**

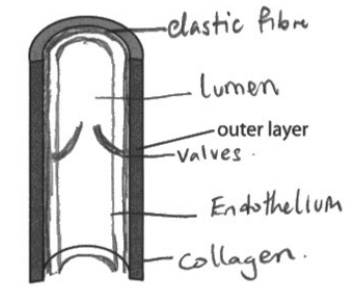
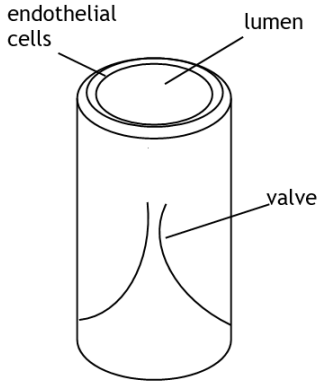
Question number	Answer	Mark
1(a)(iii)	**C**  ***A*** *is incorrect because complementary bases are joined by hydrogen bonds* ***B*** *is incorrect because one large base and one small base are joined together by hydrogen bonds* ***D*** *is incorrect because one large base and one small base are joined together*	**(1)**

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>1(b)(i)</td><td>
<table>
<tr><th rowspan="2">Statement</th><th colspan="4">Correct statement about</th></tr>
<tr><th>both strands</th><th>only the complementary DNA strand</th><th>only the mRNA strand</th><th>neither strand</th></tr>
<tr><td>The number of guanines will be the same as in the template strand</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>The number of thymines will be the same as the number of adenines in the template strand</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>There will be no adenine present</td><td></td><td></td><td></td><td>X</td></tr>
</table>
</td><td>(3)</td></tr>
</table>

Question number	Answer	Additional guidance	Mark
1(b)(ii)	transcription (1)	**IGNORE** {post-transcription modification /protein synthesis} **DO NOT ACCEPT** {translation / reverse transcription}	**(1)**

Question number	Answer	Additional guidance	Mark
2(a)	An answer that includes the following points: • number of minutes in one day calculated (1) • volume in 24 hours given in standard form (1) OR • volume in one hour calculated (1) • volume in 24 hours given in standard form (1)	1 × 60 × 24 = 1440 7.2×10^3 (litres) 5 x 60 = 300 7.2 × 103 (litres) Correct answer with no working (2) Correct answer not in standard form = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)	An answer that includes one similarity and one difference: Similarities: • both have walls containing {muscle cells / elastic fibres / an endothelial cell lining / an (outer) collagen layer} (1) • both have a valve (at the point they leave the heart) (1) Differences: • aorta has a {lumen with a wider diameter / thicker wall / more elastic tissue / more muscle tissue / more collagen} (1) • aorta has branches to more organs (1)		**(2)**

Question number	Answer	Additional guidance	Mark
2(c)	An answer that includes three of the following points: • addition to diagram {additional one or two layers of wall / valves}. If valves, must be correct orientation (1) Any two from: • {endothelial cell / tunica intima} lining labelled (1) • valve labelled (1) • {(smooth) muscle / elastic fibres / tunica media} labelled (1) • lumen labelled (1)	 	**(3)**

Question number	Answer	Mark
3(a)(i)	A α glucose molecules join together by a condensation reaction B is incorrect because bonds form by condensation reactions C is incorrect because α glucose molecules join together D is incorrect because α glucose molecules join together by condensation reactions	**(1)**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	glycosidic (bond / link)	**Accept covalent** (bond) Ignore any numbers eg 1,4 glycosidic	**(1)**

Question number	Answer	Additional guidance	Mark
3(a)(iii)	An explanation that includes the following points: • {polymer of glucose / polysaccharide} therefore has a high energy content (1) • {large molecule / polymer / polysaccharide} therefore {insoluble / has no osmotic effect} (1) • branched structure therefore {broken down / energy released / hydrolysis is} faster (1) • compact therefore has a high energy density (1)	**Accept** {large molecule / polymer} so does not diffuse **Accept** branched so can be broken down from several points at the same time **Ignore** easier to break down **Accept** compact so {high energy stored in a small space / many glucose molecules stored in a small space}	**(3)**

Question number	Answer	Additional guidance	Mark
3(b)(i)	Answer that includes the following points: • estimate of number of babies with GSD (1) • estimate of mean number of babies with Von Gierke disease (1)	 Accept any value between 150 and 200 Accept any value between 38 and 50 Accept non-whole numbers eg 38.5 Correct answer with no working (2)	 **(2)**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An answer that includes the following points: • because allele for Von Gierke disease may be recessive (1) • therefore (both) parents may be heterozygous (1) • because individuals with Von Gierke disease are less likely to have babies (1)	 **Accept** disease caused by two recessive alleles **Do not accept** {gene / disease} is recessive **Accept** parents may be carriers (of the allele) **Ignore** mutation	 **(2)**

Question number	Answer	Additional guidance	Mark
4(a)(i)	• bind to an {oxygen (molecule) / O_2} (1)	**Do not accept** O **Ignore** binding to carbon dioxide	**(1)**

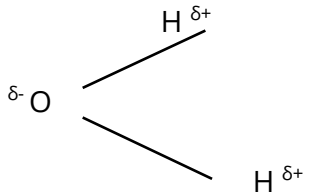
Question number	Answer	Additional guidance	Mark
4(a)(ii)	An explanation that includes the following points: • must have R groups that are {polar / hydrophilic} (1) • so that the {haemoglobin / protein} {can dissolve in (red blood cell) cytoplasm / is soluble in water} (1)	**Accept** they are {polar / hydrophilic} **Ignore** dissolve in blood / plasma	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(i)	An explanation that includes two of the following points: • oxygen dissociation curve for {maternal / adult} Hb is shifted to the right of curve for fetal Hb (1) • because oxygen needs to diffuse from {maternal / adult} blood into fetal blood (1) • therefore fetal haemoglobin needs to have a higher affinity for oxygen (1)	Accept shifted down for shifted to the right Accept converse Accept converse Accept because oxygen needs to dissociate from maternal haemoglobin and bind to fetal haemoglobin	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An answer that includes the following points: • total number of amino acids in haemoglobin calculated (1) • percentage of amino acids that are different calculated (1)	574 / 287 14 / 13.6 / 13.59 Correct answer with no working (2)	**(2)**

Question number	Answer	Additional guidance	Mark
5(a)	An explanation that includes the following points: • because it shows that it is {made of two layers of phospholipid / a bilayer} (1) • the size of a phospholipid is in the range 2.05 nm to 2.65 nm (1) • therefore the width of the membrane (5 nm) is within a bilayer range (of 4.1 nm to 5.3 nm) (1)	**Accept** it shows two layers of phosphate heads separated by a band of lipids	**(3)**

Question number	Answer	Additional guidance	Mark
5(b)	An explanation that includes three of the following points: • cholesterol is a non-polar molecule (1) • fatty acid tails are non-polar (1) • cholesterol will be located within the {fatty acid tails / non-polar part} of membrane (1) • OH group will be located near the phosphate heads (1)	**Accept** hydrophobic for non-polar in all points Accept {hydrocarbon tail / hydrocarbon rings} are non-polar	**(3)**

Question number	Answer	Additional guidance	Mark
5(c)(i)	A description that includes the following points: • {small / weak / delta / partial} positive charge on hydrogen (1) • {small / weak / delta / partial} negative charge on oxygen (1)	Accept both points from a diagram  	**(2)**

Question number	Answer	Additional guidance	Mark
5(c)(ii)	An explanation that includes the following points: • water is small enough to move by {osmosis / diffusion} (between the phospholipids) (1) • steroid (is non-polar so) can diffuse through the {membrane / phospholipids} (1) • glucose (is polar so) passes through {protein channels / carrier proteins / by facilitated diffusion} (1) • ions (are polar so) pass through {protein channels / carrier proteins / by facilitated diffusion / active transport} (1)	**Accept** description of water moving through {protein channels / aquaporins} **Accept** steroid is not repelled by fatty acid tails **Accept** movement by active transport **Accept** ions are repelled by fatty acid tails so cannot get through membrane	**(4)**

Question number	Answer	Additional guidance	Mark
6(a)(i)	An explanation that includes the following points: • because both lines rise and fall (in parallel) (1) • but the line for deaths from lung cancer is a period of time after the line for cigarettes smoked (1)	**Accept** {delay / timelag} for deaths	**(2)**

Question number	Answer	Additional guidance	Mark
6(a)(ii)	An explanation that includes the following points: • alveoli will have a smaller surface area (to volume ratio) (1) • therefore the (rate of) diffusion of oxygen into the bloodstream will be slower (1)	**Accept** gas exchange area will be smaller **Accept** gas exchange for diffusion **Ignore** less gas exchange / diffusion	**(2)**

<table>
<tr><th>Question number</th><th>Answer</th></tr>
<tr><td>*6(b)</td><td>Indicative content:
<table>
<tr><td>Egg points (E)</td><td>1. {number / density of pores}
2. {width / size} of pores
3. area of pores
4. thickness of shell and membranes
5. rate of respiration of developing embryo
6. rate of blood flow of embryo
7. temperature
8. shell is impermeable / pores are permeable
9. shell supports membrane so there is a large SA for gas exchange</td></tr>
<tr><td>Theory points (T)</td><td>10. Ficks Law of diffusion can be used to calculate diffusion rate
11. State Fick’s Law (3)
12. because rate of diffusion depends on surface area / mp11
13. because rate of diffusion depends on diffusion distance / mp11
14. because rate of diffusion depends on concentration gradient / mp11
15. speed of molecules depends on temperature
16. because rate of diffusion depends on what substances oxygen is passing through eg water / air
17. diffusion coefficient through air
18. diffusion coefficient through membranes</td></tr>
<tr><td>Explanation points (X)
Accept converse for all</td><td>19. increasing SA (or any named factor increasing this) causes increase in rate of diffusion
20. increasing distance (or any named factor increasing this) causes decrease in rate of diffusion
21. increasing conc gradient (or any named factor increasing this) causes increase in rate of diffusion
22. increasing temperature increases rate of diffusion</td></tr>
</table></td></tr>
</table>

	Level 1 Up to 4 points from anywhere; 2 points for one mark and 4 points for 2 marks Level 2 5 points or more, from two best categories; 5 points for 3 marks, 6 points for 4 marks. Must achieve 6 marks to progress to level 3 Level 3 As level 2 plus up to 2 points from third category; 7 points for 5 marks and 8 points for 6 marks

Question number	Answer	Additional guidance	Mark
7(a)	One from • high BMI / smoking / alcohol intake / high salt intake / high cholesterol intake And one from • age / sex / gender	Accept: obesity / overweight / high waist to hip ratio high level of {fat / sugar} in diet type 2 diabetes high stress levels air pollution	**(1)**

Question number	Answer	Additional guidance	Mark
7(b)	A description that includes two of the following points: • increase in intensity of exercise decreases the risk of death from heart disease (1) • increase in the energy needed for exercise decreases the risk of death from heart disease (1) • for the same energy expenditure, {vigorous exercise / moderate exercise} decreases risk of death from CVD more than light exercise (1)	**Accept** converse throughout Accept if you expend 4000kJ per week, intensity of exercise makes no difference to risk of death from CVD	**(2)**

Question number	Answer	Additional guidance	Mark
7(c)(i)	An explanation that includes the following points: • because antioxidants reduce free radicals (1) • free radicals cause {cell damage /tissue damage / oxidative stress / damage to endothelial lining} (1) • (antioxidants) reduce {plaque / atheroma} formation (1)	**Accept** neutralise / stabilise / donate electrons **Accept** antioxidants {prevent cell damage / tissue damage / reduce oxidative stress / prevent damage to endothelial lining} **Accept** reduces {cholesterol build up / blood clot formation / atherosclerosis}	**(3)**

Question number	Answer	Additional guidance	Mark
7(c)(ii)	An answer that includes three of the following points: • use (a large number of) {healthy individuals / individuals with no known heart condition} (1) • who have similar (lifestyle and non-lifestyle) risk factors (1) • compare group given antioxidants to a group using other preventative treatments (1) • monitor the incidence of heart disease over a (long) period of time (1)	**Accept** control for named factor **Accept** give one group antioxidants and the other group **{**a placebo / no antioxidants} **Accept** at least 6 months if time is given	**(3)**

<table>
<tr><th>Question number</th><th>Answer</th></tr>
<tr><td>*7(d)</td><td>Indicative content:
<table>
<tr><td>Outline of events (O points)</td><td>1. less blood reaches the heart muscle cells,
2. muscle cells are not supplied with enough oxygen
3. muscle cells are not supplied with enough glucose
4. aerobic respiration decreases</td></tr>
<tr><td>Contraction stops (C points)</td><td>5. anaerobic respiration produces lactic acid
6. lactic acid lowers pH and denatures enzymes
7. glycogen used as respiratory substrate
8. anaerobic respiration produces much less ATP / energy
9. therefore less / no blood is pumped by the heart
10. reference to effect on other organs</td></tr>
<tr><td>Use of graph / stem info (G points)</td><td>11. energy released from heart cells decreases with time after blockage
12. reference to data from graph (not mp13 or 15)
13. after 8 minutes the energy released is 52 - 54 a.u.
14. after 8 minutes there is not enough energy for contraction
15. after 20 minutes the energy released is 23 - 24 a.u.
16. which is too low to maintain cell viability / for cells to survive
17. cells die as not enough ATP for vital processes eg active transport</td></tr>
</table>
Level 1: up to two points from anywhere; one point for 1 mark and two points for 2 marks

Level 2: up to two points from each of two categories; 3 points for 3 marks, 4 points for 4 marks
Must achieve 4 marks to progress to level 3

Level 3: Level 2 plus two points from the third category; five points for 5 marks and six points for 6 marks</td></tr>
</table>

Question number	Answer	Mark
8(a)(i)	C galactose and glucose A is incorrect because lactose consists of glucose and galactose monomers B is incorrect because lactose consists of glucose and galactose monomers Dis incorrect because lactose consists of glucose and galactose monomers	(1)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An explanation that includes three of the following points: • lactase is soluble because of its {globular shape / external polar R groups} (1) • (and therefore) lactase collides with lactose (1) • active site of lactase is complementary to the lactose (1) • Formation of enzyme-substrate complex lowers the activation energy (1)	**Accept** hydrophilic for polar **Accept** active site of lactase binds to lactose / active site allows enzyme-substrate complex to form **Accept** R group interactions break the glycosidic bonds	(3)

Question number	Answer	Additional guidance	Mark
8(b)(i)	• {lactase / enzyme} is reusable / milk is not contaminated with {lactase / enzyme} (1)	**Accept** higher enzyme activity	**(1)**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation that includes four of the following points: • pH {below 5 / above 5} reduces lactase activity (1) • because pH affects the shape of the active site (1) • due to ionisation of the R groups (1) • immobilised lactase is active at wider range of pH values (1) • immobilisation holds the R groups in place so active site does not change shape (1)	**Accept** pH 5 is the optimum for both enzymes / pH 4-6 is the optimum for both enzymes **Accept** active site denatured by pH **Accept** bonds between R groups are broken	**(4)**

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>8(b)(iii)</td><td>An answer that includes the following points:

• measure the decrease in concentration of lactose over time
• see table for units

OR

• measure the increase in concentration of {glucose / galactose} over time
• see table for units</td><td>Accept measure rate of loss of lactose
Ignore: measure how long it takes for lactose to be fully broken down

Accept measure rate of production of {glucose / galactose}

Units can be expressed as:
• mass per volume per time
• mass volume^{-1} time^{-1}
• amount per volume per time
• amount volume^{-1} time^{-1}

<table><tr><td>mass</td><td>volume</td><td>time</td></tr><tr><td>g / mg / µg / kg</td><td>cm^{-3} / mm^{-3} / dm^{-3} / litre^{-1}</td><td>s^{-1} / min^{-1} / hour^{-1}</td></tr><tr><td></td><td></td><td></td></tr><tr><td>amount</td><td>volume</td><td>time</td></tr><tr><td>mmol / mol / µmol</td><td>cm^{-3} / mm^{-3} / dm^{-3} / litre^{-1}</td><td>s^{-1} / min^{-1} / hour^{-1}</td></tr></table></td><td>(2)</td></tr>
</table>

Question number	Answer	Additional guidance	Mark
8(c)	An answer that includes two of the following points: • mutation (that resulted in CLI) occurred in the {gene / DNA} (of people living in one country) (1) • people from this country (had children that) stayed in this country (1) • relatively new mutation so has not had the chance to spread (1)	**Accept** limited emigration from this country / reproduction with others from same country Ignore idea that mutation is caused by drinking milk / not drinking milk	**(2)**

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