Pearson Edexcel

Mark Scheme (Results)

Summer 2025

Pearson Edexcel Level 3 Advanced GCE In Biology B (9BI0)
Paper 01: Advanced Biochemistry, Microbiology and Genetics

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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 only correct answer is A** **B** is incorrect because when ATP is hydrolysed it releases energy **C** is incorrect because ATP is hydrolysed not phosphorylated **D** is incorrect because ATP is hydrolysed not phosphorylated		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	**The only correct answer is A** **B** is incorrect because large hydrophobic molecules can diffuse through the phospholipid bilayer C is incorrect because small hydrophobic molecules can diffuse through the phospholipid bilayer **D** is incorrect because water passes by osmosis from a high solute potential to a lower solute potential		(1)

Question Number	Answer	Additional Guidance	Mark
1 (c)	An explanation that makes reference to the following: • (0 to 10 minutes) molecule A increases faster because active transport is faster than diffusion (1) • (20 to 30 minutes) concentration of molecule B levels off as there is no longer a {concentration/diffusion} gradient (1)	Accept A is transported by active transport and B by diffusion for 1 mark. Accept B has reached equilibrium/concentration equal inside and outside	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)	**The only correct answer is D** **A** is incorrect because glycerate 3-phosphate is an intermediary of glycolysis **B** is incorrect because glycogen is a storage molecule **C** is incorrect because lactate is the product of anaerobic respiration		(1)

Question Number	Answer	Additional Guidance	Mark
2(b)	**The only correct answer is B** **A** is incorrect because only glycolysis occurs in the cytoplasm **C** is incorrect because glycolysis takes place in the cytoplasm **D** is incorrect because glycolysis takes place in the cytoplasm		(1)

Question Number	Answer	Additional Guidance	Mark
2 (c)(i)	• free energy in 36 ATP molecules calculated (1) • correct answer calculated (1)	(30 566 × 36 =) 1 100 376 38.34 = 2 marks Correct answer gains full marks	(2)

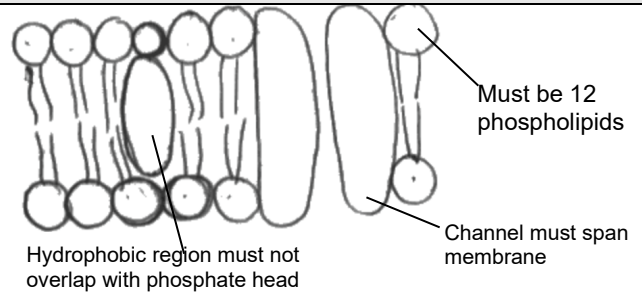
Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	• heat (energy) is lost (1)	Accept thermal energy	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)	• viruses can only {attach to/bind /infect} specific (host) cells / viruses are not living so can only replicate inside cells (1)	Do NOT accept viruses reproduce	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)	An explanation that makes reference to the following: • because the temperature has to be suitable for the enzymes of the cells to function (1) • because enough time has to be allowed for {viral replication / lytic cycle/lysis} (1)	So that the enzymes in the cell do not denature Ignore reproduce	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)	An explanation that makes reference to the following: • because viruses burst out of their (host) cells into the culture fluid (1) • a filter will be selected that allows the viruses through and not the cells (1) • most of the host cells will be attached to the culture flask (1)	Accept the cells have been lysed/fragmented Accept cells are too big (to pass through the filter/filtration unit)	(3)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	**The only correct answer is B** **A** is incorrect because R is the hydrophilic phosphate and S is the hydrophobic fatty acid **C** is incorrect because R is the hydrophilic phosphate and S is the hydrophobic fatty acid **D** is incorrect because R is the hydrophilic phosphate and S is the hydrophobic fatty acid		(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	An answer that makes reference to the following: • 12 phospholipids arranged in a bilayer and channel protein spanning the width of the bilayer (1) • cholesterol drawn showing hydrophilic region {in / adjacent} to phosphate heads and hydrophobic region in amongst fatty acids (1)		(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	A description that makes reference to the following: • to provide a hydrophilic channel (through the bilayer) (1) • for facilitated diffusion (1)	Accept allow movement of {hydrophilic molecules/large/polar/charged molecules/ions}	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	An answer that makes reference to the following: • as temperature increases the permeability increases (1) • (presence of cholesterol) decreases permeability / increase in cholesterol decreases permeability (1)	Accept converse – no cholesterol, membrane is more permeable	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	An explanation that makes reference to the following: • (Low heat energy of phospholipids) so very little kinetic energy (1) • phospholipids do not move so {molecules not able to/less pass through/ low rate of diffusion} (1)	Accept other terms e.g less fluid eq to do not move	(2)

Question Number	Answer	Additional Guidance	Mark
5(a)	**The only correct answer is A** **B** is incorrect because TS is monosomy not polysomy **C** is incorrect because TS is non-disjunction not translocation **D** is incorrect because TS is non-disjunction not translocation		(1)

Question Number	Answer	Additional Guidance	Mark
5(b)	• number of baby girls born calculated (1) • (number of baby girls with TS) calculated (1)	(613 936 ÷ 2.05 =) 299 481/299480.976 299 481 ÷ 2500 = 119.7924 119/120 Correct answer 119/120 gains full marks	(2)

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	An explanation that makes reference to the following: • because the vaccine will stimulate a (primary) immune response (1) • so there will be a higher number of {lymphocytes / antibodies} (1) • giving false-positive results (1)	Accept they will have memory cells Do Not accept a change in lymphocyte/antibody levels Accept {making the study/results of the study invalid/results skewed}	(3)

Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	An explanation that makes reference to the following: • standardised height score (1) • because {the standard deviation values do not overlap/ the error bars do not overlap with the other group} (1)	Accept smallest value for group w/o TS is -0.91 and largest value with TS is -1.21	(2)

Question Number	Answer	Additional Guidance	Mark
5(c)(iii)	An answer that makes reference to the following: • girls with TS have lower levels of IgG/IgA (1) • girls with TS have fewer CD4 cells but {the same / more} CD8 cells (1) • No significant difference (in the levels of antibodies and lymphocytes)/ error bars overlap (1)	Do not piece together Accept: Apart from CD8 lymphocytes all the other markers are lower in girls with TS = 2 marks	(2)

Question Number	Answer	Additional Guidance	Mark
5(c)(iv)	An explanation that makes reference to two of the following: • Girls from both groups (from the study) divided into those with autoimmune disease and those without (1) • So that one group has TS and autoimmune disease/one group has TS and no autoimmune disease (1) • so that the numbers of T regulatory cells could be compared (1)		(2)

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	**The only correct answer is D** **A** is incorrect because crista are in mitochondria **B** is incorrect because the photosystems are not in the inner membrane **D** is incorrect because the photosystems are not in the outer membrane		(1)

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	• photolysis (1)		(1)

Question Number	Answer	Additional Guidance	Mark
6(a)(iii)	**The only correct answer is C** **A** is incorrect because reduced NADP is formed **B** is incorrect because reduced NADP is formed **D** is incorrect because an electron is gained when a substance is reduced		(1)

Question Number	Answer	Additional Guidance	Mark
6(a)(iv)	• ADP + Pi → ATP (1)	**ACCEPT** ADP / adenosine diphosphate Pi / phosphate / phosphate ions ATP / adenosine triphosphate **Do not accept any other arrow**	(1)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	An answer that makes reference to the following: • Correct value calculated from graph (1) • Answer calculated (1)	(18.5 – 0.5) ÷ 14 = 1.28571428571 × 10^6 ÷ 1.04 × 10^6 = 1.236 1.2 1.3 gains 1 mark Correct answer gains 2 marks	(2)

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	An explanation that makes reference to the following: • darker green (because synthesis of) {more photosynthetic pigments /more chlorophyll/more chloroplasts} (1) • (more pigments) absorb **more** light for photosynthesis (1) • cells not increased in number as number of new cells equals number of dying cells /stationary phase (1) • explanation of death phase (1) • credit one reason explained for cells entering death phase (1) • credit second reason explained for cells entering death phase (1)	Accept converse cells in natural light still dividing (by mitosis) e.g more cells are dying than are being produced e.g. limiting factors are: (visible) light minerals/ carbon dioxide build up of toxins/waste in the culture space	(5)

Question Number	Answer	Additional Guidance	Mark
6(b)(iii)	An explanation that makes reference to the following: • *Chlorella* produce several (different photosynthetic) pigments (1) • therefore {maximises/more} light absorption(1) • therefore {maximises/more} production of electricity (by the solar cells) (1)		(3)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>7(a)(i)</td><td>An answer that makes reference to the following:

• 200 μm converted into m (1)

• surface area of one alveolus calculated (1)

• total surface area of a pair of lungs (1)

<table>
<tr><th>Value for π</th><th>Area of one alveolus (2)</th><th>Area of lung (2)</th><th>Area of two lungs (3 marks)</th></tr>
<tr><td>3</td><td>1.2×10^{-7}</td><td>36</td><td>72</td></tr>
<tr><td>3.14</td><td>1.26×10^{-7}</td><td>37.7</td><td>75.4</td></tr>
</table>
</td><td>(200 ÷ 100 0000 =) 0.0002

(4 × 3 × 0.0001 × 0.0001=) 1.2×10^{-7} / 1.26×10^{-7}

2 × 300 million × 1.2×10^{-7}

72/75.36/75.4
Correct answer gains full marks

72/75.4 to wrong order of magnitude = 2 marks
36/37.7 to wrong order of magnitude = 1 mark
301.44 = 1 mark (diameter instead of radius)
$0.0002/2 \times 10^{-4}$ = 1 mark</td><td>(3)</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>7(a)(ii)</td><td>An explanation that makes reference to the following:

• because gas exchange will be faster/increased rate of diffusion (of gases) (1)

• supplying {sufficient/more} oxygen for respiration (1)</td><td>Ignore efficiently/more</td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
7(a)(iii)	An explanation that makes reference to two of the following: • (because fluid is needed) for {oxygen/gases} to dissolve in (before it can diffuse into the blood) (1) • because (fluid/surfactant) prevents the {lungs / alveoli} collapsing (1) • (because fluid is needed) to maintain the alveolar membrane (1)	Allow oxygen in solution So the alveoli don't stick together	(2)

Question Number	Answer	Additional Guidance	Mark
7(b)	An explanation that makes reference to three of the following: • has {ostia/gaps} to allow water to flow into the body to maintain concentration gradient (1) • single layer of cells lining the body cavity so that the gas {exchange surface is thin/shorter diffusion distance} (1) • cells possess flagella to {increase surface area/ keep the water flowing} (1) • the shape of cavity/sponge provides a large surface area (1)	Accept the unidirectional movement of water maintains concentration gradient Accept a description of the shape linked to SA	(3)

Question Number	Answer	Additional Guidance	Mark
7(c)	An explanation that makes reference to the following: • use of gills decreases as the tadpole develops into frog and breathing air(1) • use of lungs increases as the tadpole develops to frog and using oxygen in air(1) • the skin is used for gas exchange in all developmental stages of the frog (1) • the skin is used in the tadpole because it has a high surface area to volume ratio (1) • in the adult frog the skin is less important than the lungs in taking up oxygen but more important in releasing carbon dioxide (1)	Accept gills in tadpole as taking oxygen from the water Accept lungs are {not used/developed} when the tadpole lives in water Piece together Skin is most important at releasing carbon dioxide at all stages (piece together)	(4)

Question Number	Answer	Additional Guidance	Mark
8(a)	**The only correct answer is C** **A** is incorrect because neither carbohydrates not lipids contain N **B** is incorrect because lipids do not contain N **D** is incorrect because carbohydrates do not contain N		(1)

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	**The only correct answer is B** **A** is incorrect because the mesophyll layer is the gas exchange surface **C** is incorrect because the mesophyll layer is the gas exchange surface **D** is incorrect because the mesophyll layer is the gas exchange surface		(1)

Question Number	Indicative content	
***8(b)(ii)**	Indicative content: Depth of layers • smaller in low N (D)/(larger in high N (D)) • therefore mesophyll layer may be narrower (E) • therefore less chlorophyll for light-dependent stages (E) • therefore less stroma / RUBISCO for Calvin cycle (E) • therefore diffusion of gases will be higher (E) • therefore higher concentration of carbon dioxide for Calvin cycle (E) • Allow converse for all statements above (E) Size of chloroplasts • smaller in low N (D)/ (larger in high N (D)) • therefore less chlorophyll for light-dependent stages/less light absorbed (E) • therefore less ATP/NADPH (E) • less stroma / RUBISCO for Calvin cycle (E) • therefore RUBISCO maybe at a lower concentration • therefore Calvin cycle will be slower • Allow converse for all statements above (E) Surface area of chloroplasts exposed to intercellular air space • lower in low N plants (D)/ (higher in high N (D)) • therefore reduced gas exchange (E) • therefore lower concentration of carbon dioxide (E) • so Calvin cycle will be slower (E) • converse of statements above (E) RUBISCO activity • lower in low N (D) • lower in high N (D) • therefore Calvin cycle will be slower (E) • as RUBISCO catalyses carbon fixation (E) • and rate of reaction decreases with decrease in enzyme concentration (E)	Allow converse for all statements **Level 1** 1 mark = description of 2 characteristics 2 marks = explanation for 1 of the characteristics **Level 2 :** 3 marks = explanation for 2 of the characteristics 4 marks = explanation for 3 of the characteristics **Level 3:** 5 marks = extended explanation for 3 of the characteristics 6 marks = extended explanation for all 4 characteristics

	Marks	AO2 discuss
0	0	No awardable content
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.
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.

3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

Question Number	Answer	Additional Guidance	Mark
8(c)(i)	An answer that makes reference to three of the following: **Any two from** • more {changes/increase/decrease} in gene expression in low levels of nitrogen (1) • more genes were not expressed in plants than expressed in both groups of plants (1) • some of the genes that were either expressed or not expressed were the same in both groups of plants (1) **And** • calculation used to illustrate at least one of the changes (1)	e.g Low levels 467 genes increased, 924 increased. High levels 294 genes increased, 601 decreased. Expression of 200 genes was similar in high and low levels of N. 496 more genes were affected in low levels than high levels.	(3)

Question Number	Answer	Additional Guidance	Mark
8(c)(ii)	A description that makes reference to the following: • epigenetic modification (1) • credit example of epigenetic modification (1)	 e.g. methylation, transcription factors, histone modification, acetylation	 (2)

Question Number	Answer	Additional Guidance	Mark
9(a)	An answer that makes reference to three of the following: Similarities: • both consist of {(mono) nucleotides / adenine, guanine and cytosine} (1) • both contain phosphodiester bonds (1) Differences: • DNA has thymine whereas RNA has uracil (1) • DNA has deoxyribose whereas RNA has ribose (1)	 DO NOT ACCEPT A,G,C **DO NOT ACCEPT** hydrogen bonds DO NOT ACCEPT T and U	 (3)

Question Number	Answer	Additional Guidance	Mark
9(b)	A description that makes reference to four of the following: • use of reverse transcriptase to synthesise a DNA copy of the RNA strand (1) • details of the molecules needed in the PCR process (1) • details of the PCR process (1) • repeated cycles (1) • {use of RNA polymerase / transcription} of DNA to make RNA (1)	Reverse transcription to convert RNA aptamer to DNA e.g. primers, buffers, DNA mononucleotides, DNA polymerase (2 of these) e.g. temperature cycles (high to break bonds, lower to synthesise DNA)	(4)

Question Number	Indicative content	
***9(c)**	Indicative content: Graph 1: AT3 has the highest strength of binding of all with H1 AT1 binds the least except for H5 AT2 binds most to H7/least to H5 AT3 binds the most for all types apart from H7 All Aptamers bind to each haemagglutinin Graph 2: All Aptamers bind to all strains AT3 is binds strongest to W and Y and Z AT 2 binds strongest to X AT1 binds least to apart from Y Viral infections: • viruses attach to host cells • by attachment sites binding to receptor molecules • influenza uses haemagglutinin to bind to host cells Advantages of aptamers: • aptamer binding to haemagglutinin prevents attachment of influenza to host cell • virus cannot enter host cell and replicate • therefore viral infection will not spread • aptamers can bind to different strains of influenza and prevent infection by a range of strains • offering greater protection • aptamers can bind to a different types of haemagglutinin and therefore should prevent infection by a range of strains • offering greater protection • could bind to other {strains / haemagglutinins} that may result from mutations in the virus • offering further protection against new strains	**Level 1** 1 mark = any two comments 2 marks = 3 descriptions **or** 1 description and 2 adv/disadv **or** 2 descriptions and 1 adv/disadv **Level 2 :** **Minimum 3 descriptions +** 3 marks = 1 advantage / disadvantage 4 marks = 2 advantages / disadvantages **Level 3** **Minimum 3 descriptions +** 5 marks = 3 statements that include at least one advantage and one disadvantage 6 marks = 4 statements that include at least one advantage

	Disadvantages of aptamers: • virus may mutate and aptamer may not be able to bind • not part of the immune system • not in immunological memory • so protection could be short-lived • new treatment so {long term / side effects} not known • no details on how long they last in the body • as they bind to a range of haemagglutinins they may bind to other molecules/cells • reference to lack of error bars and therefore cannot determine significance of results	and one disadvantage

	Marks	AO2 discuss
0	0	No awardable content
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.

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3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts. Consequences are discussed which are supported throughout by sustained linkage to a range of scientific ideas, processes, techniques or procedures. The discussion shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

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