Mark Scheme (Results)

October 2020

Pearson Edexcel GCE
In Biology B (9BI0/01)
Paper 1: 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.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1</td><td>
<table>
<tr><th>Structure</th><th>Name of structure</th><th>Number of sets of chromosomes</th></tr>
<tr><td>J</td><td>egg cell / female gamete</td><td>one / haploid / n</td></tr>
<tr><td>K</td><td>polar nucleus / nucleus that forms the endosperm nucleus</td><td>one / haploid / n</td></tr>
<tr><td>L</td><td>male gamete</td><td>one / haploid / n</td></tr>
<tr><td>M</td><td>(pollen) tube nucleus</td><td>one / haploid / n</td></tr>
</table>
(1)
(1)
(1)
(1)
</td><td>NB Any two correct cells = 1 mark

ACCEPT ovum / ova

ACCEPT pleural

ACCEPT male / sperm nucleus
pleurals

DO NOT ACCEPT generative nucleus</td><td>(4)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
2(a)	• (high) hydrostatic pressure forces {fluid / plasma} out of the capillaries (at the arteriole end) (1)		(1)

Question Number	Answer	Additional Guidance	Mark
2(b)	An explanation that makes reference to the following: • blood plasma has higher protein content as the {plasma proteins / named plasma protein / some proteins} are too large to pass out of {capillary / blood} (1) • tissue fluid has less (dissolved) oxygen as it has {<u>diffused</u> into / respired by} the {cells / tissues} (1)	**ACCEPT** converse for tissue fluid **ACCEPT** converse for plasma	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)	An answer that makes reference to the following: • tissue fluid enters the lymphatic (vessels / system) (1) • lymph returns to {the (subclavian) veins / blood} (1)		(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• *Anopheles*	**DO NOT ACCEPT** *Anopheles gambiae*	(1)CL

Question Number	Answer	Mark
3(a)(ii)	**The only correct answer is C Order** ***A*** *is incorrect because organisms in orders are sub-divided into families* ***B*** *is incorrect because organisms in families are sub-divided into a genus* ***D*** *is incorrect because organisms in phylum are sub-divided into classes*	(1)

Question Number	Answer	Mark
3(a)(iii)	**The only correct answer is B** *Plasmodium falciparum* ***A*** *is incorrect because Anopheles gambiae is the vector and not the pathogen* ***C*** *is incorrect because Puccinia graminis causes stem rust* ***D*** *is incorrect because Salmonella enterica causes food poisoning*	(1)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	An explanation that makes reference to **one pair** from the following: • mosquito coils / mosquito nets / insect repellent (1) • because {too expensive / not always available} (1) OR • anti-malarial tablets (1) • because {too expensive / not always available / side effects} (1) OR • avoiding stagnant water (1) • because impractical as people's {homes / work} are near stagnant water 1) OR • long clothing (1) • because impractical for working (1) OR	**ACCEPT** {removing / adding chemicals} to stagnant water **ACCEPT** affects organisms living in the water	(2)

	• insecticide (1) • expensive / can {poison / kill} other organisms / can affect the food chain (1) OR • sterile insect technique (1) • not fully tested / expensive (1) OR • biological control (1) • can affect the food chain (1)		

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	• percentage of deaths in 2015 compared to 2010 (1) • number of deaths in 2010 (1)	<u>Example of calculation:</u> 100 - 29 = 71 429 000 × 100 ÷ 71 = 604 225 / 604 000	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)	• answer in standard form	e.g. 0.5×10^7 / 5×10^6	(1)

Question Number	Answer	Additional Guidance	Mark
3(d)	An explanation that makes reference to the following: • because they want to validate their results (1) • by other members of the scientific community {checking / repeating / discussing / criticising} their work (1)	**ACCEPT** peer review to check . . .	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	**C** monocyte | eosinophil	**A** is incorrect because cell J is not an eosinophil and cell K is not a lymphocyte **B** is incorrect because cell J is not a lymphocyte and cell K is not a neutrophil **D** is incorrect because cell J is not a neutrophil and cell K is not a monocyte	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	**D** 50 : 3	**A** is incorrect because there are about 50 erythrocytes and 3 leukocytes **B** is incorrect because there are about 50 erythrocytes and 3 leukocytes ie the ratio is the wrong way round **C** is incorrect because there are 3 leucocytes	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)	An explanation that makes reference to the following: • because the numbers of erythrocytes to leucocytes can be determined (1) • and compared to the {normal / healthy / known CML} (smear) (1)	**ACCEPT** red blood cells to white blood cells named white blood cell	(2)

Question Number	Answer	Additional Guidance	Mark
4(c)	An explanation that makes reference to four of the following: • by epigenetic modification (1) • for example by {DNA methylation / histone methylation / histone acetylation} (1) • {house-keeping genes / genes needed in both cell types} remain switched on (1) • genes needed in {common lymphoid progenitor / lymphoid} cells become (permanently) switched off (1) • causing {proteins / named protein} to be made that are specific to the {cell type / named cell} (1)	**ACCEPT** descriptions / post-transcriptional modification transcription of genes switched on / no transcription of genes switched off **ACCEPT** converse **ACCEPT** converse credit a named example of a gene which may be switched {on / off} e.g. gene coding for cytokines in T lymphocytes **NB** genes become switched on or off = 1 mark, if no other marks awarded	(4)

Question Number	Indicative content
***5(a)**	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content: • IgM produced early in response (D) • has multiple antigen-binding sites (D) • involved in agglutination of the viruses (R) • IgA produced early in response (D) • can bind two antigens (D) • so involved in agglutination of the viruses (R) • involved in opsonisation (R) • to enhance phagocytosis by phagocytes (R) • is present in {eyes / nasal passages} (D) • to prevent entry of pathogen through {eyes / nose} (R) • can provide passive immunity to newborn baby (R) • IgG persists in body for a few months (D) • providing immunity to virus (R) • has two antigen-binding sites (D) • involved in agglutination of the viruses (R) • involved in opsonisation (R) • to enhance phagocytosis (R) • can cross the placenta to provide passive immunity to the fetus (R) • IgD will be involved in B cell activation (R)

	• as it will bind virus to B cell (R) • activated B cells will differentiate into plasma cells that will produce antibody (R) • IgE not involved as Rubella infection {is not a parasitic infection / does not result in an allergic response} (R) **Level 1 :** 1 mark = description of antibodies from either the graph or the table 2 marks = description of antibodies from both the graph and the table / role of one class of antibody described **Level 2 :** 3 marks = role of two classes of antibody described 4 marks = role of three classes of antibody described **Level 3 :** 5 marks = role of four classes of antibody described 6 marks = role of all five classes of antibody described	
Level	Marks	
0	0	No awardable content
1	1-2 (1-3)	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 (4-6)	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 (7-9)	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
5(b)	An explanation that makes reference to two of the following: • because it results in herd immunity (1) • therefore there will be fewer infected people to pass virus onto uninfected people (1) • protect people who cannot become immune (1)	**ACCEPT** large number of people immunised reduces the chance of someone not immune getting infected e.g. allergic to vaccines, immunodeficient, immunosuppressed, HIV	(2)

Question Number	Answer	Additional Guidance	Mark

6(a)	<table><tr><th rowspan="2">Virus</th><th colspan="4">Classification of viruses</th></tr><tr><th>DNA enveloped</th><th>DNA non-enveloped</th><th>RNA enveloped</th><th>RNA non-enveloped</th></tr><tr><td>Ebola</td><td>☐</td><td>☐</td><td>X</td><td>☐</td></tr><tr><td>λ (lambda) phage</td><td>☐</td><td>X</td><td>☐</td><td>☐</td></tr><tr><td>Tobacco mosaic</td><td>☐</td><td>☐</td><td>☐</td><td>X</td></tr></table>		(3)

Question Number	Answer	Additional Guidance	Mark
6(b)	• number of patients with gastroenteritis caused by viruses (1) • pie chart used to estimate proportion of cases caused by noroviruses (1) • total number of gastroenteritis cases caused by noroviruses (1)	<u>Example of calculation:</u> 162 × 24.7 ÷ 100 = 40 (40.014) 60 - 70 % 24, 25, 26, 27, 28 people Correct answer with no working gains full marks	(3)

Question Number	Answer	Additional Guidance	Mark
6(c)	A description that makes reference to the following: • (viral) RNA made (1) • (viral) {capsid / protein} made (1) • assembly of viruses (1)	**ACCEPT** new virus particles made	(3)

Question Number	Answer	Additional Guidance	Mark
6(d)(i)	An explanation that makes reference to three of the following: • because more viruses delivered (1) • because {lipid / sphere} can pass through cell membrane / no need to bind to (cell) receptors / can bind to any cell (1) • because {lipid / sphere} protects viruses from {enzymes / stomach acid / phagocytes / immune system} (1) • credit a link between one reason and the information given (1)	e.g. more cells infected so symptoms develop faster	(3)

		more cells infected so symptoms are worse virus particles not destroyed so more cells infected	

Question Number	Answer	Additional Guidance	Mark
6(d)(ii)	An explanation that makes reference to two of the following: • because the lipids could be {targetted / broken down} (1) • by an enzyme (that breaks down lipid) (1) • resulting in {fewer virus particles arriving at cells (in one go) / exposure to immune system} (1)	**ACCEPT** using a drug that can penetrate the lipid **ACCEPT** therefore destroying the viruses **ACCEPT** {fewer / no} viruses (arriving at the cells)	(2)

Question Number	Answer	Mark
7(a)		(3)

Bond	**Molecule that bond may be found in**			
	carbohydrate only	lipid only	both carbohydrate and lipid	neither carbohydrate nor lipid
covalent	☐	☐	**X**	☐
ester	☐	**X**	☐	☐
hydrogen	**X**	☐	☐	☐

Question Number	Answer	Mark
7(b)(i)	The only correct answer is **B** matrix **A** is incorrect because only glycolysis takes place in the cytoplasm **C** is incorrect because stroma is in chloroplasts not mitochondria **D** is incorrect because tonoplasts are in plant cells only	(1)

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	An explanation that makes reference to three of the following: • in anaerobic conditions, the pyruvate is used to reoxidise NADH so no Krebs cycle (1) • no oxygen available to act as a (terminal) electron acceptor (1) • so reduced { NAD / FAD / coenzyme} cannot be reoxidised (1) • so no (oxidised) coenzyme to bind {hydrogen ions / protons / H^+/electrons} (1)	**ACCEPT** oxygen binds to electrons **ACCEPT** NADH / $FADH_2$	(3)

Question Number	Answer	Additional Guidance	Mark
7(c)	An explanation that makes reference to two of the following: • because a lipid molecule contains a higher proportion of hydrogen (than a carbohydrate molecule) (1) • therefore more reduced {NAD / FAD / coenzyme} (1) • therefore more hydrogen (ions) {to accumulate in the inter-membrane space / to produce a proton gradient / to pass through ATP synthase channels / for chemiosmosis / for oxidative phosphorylation} (1)	**ACCEPT** converse throughout **ACCEPT** NADH / $FADH_2$	(2)

Question Number	Answer	Additional Guidance	Mark
7(d)(i)	• when one molecule of carbohydrate is respired the number of carbon dioxide molecules produced is the same as the number of molecules of oxygen used	**ACCEPT** carbon dioxide produced = oxygen used	(1)

Question Number	Answer	Additional Guidance	Mark
7(d)(ii)	• volume of both gases calculated (1) • RQ value calculated to {1 / 2} decimal places (1)	<u>Example of calculation:</u> oxygen volume = 4.5 × 21 + 3.75 = 98.25 carbon dioxide volume = 3 × 21 + 6 = 69 69 ÷ 98.25 = 0.70 / 0.7 / 0.702 **ACCEPT** ecf	(2)

Question Number	Answer	Additional Guidance	Mark
7(e)	An explanation that makes reference to three of the following: • insect is respiring carbohydrates at rest and lipid during flight (1) • respiration of carbohydrate provides enough energy for the insect at rest (1) • it requires more {energy / ATP} (for contraction) (1) • therefore the insect has to respire lipid to provide this energy (1)	**NB** uses for respires throughout but reference to respiration must be made at least once for full marks to be awarded **PIECE TOGETHER**	(3)

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	A description that makes reference to four of the following: • sample taken from the female genital tract (1) • bacteria grown on {selective / indicator} media (1) • bacteria grown on media containing different types of antibiotics (1) • use of {antibodies / DNA profiling} (1) • using {Gram staining / cell shape / colony shape / colony colour} (1)		(4)

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	An explanation that makes reference to three of the following: • because they grow on the skin cells preventing pathogenic bacteria from doing so (1) • because they use the glycogen so less {glucose / energy / glycogen} available for the pathogenic bacteria (1) • because they produce lactic acid which inhibits the growth of pathogenic bacteria (1) • because the low pH denatures the enzymes of the pathogenic bacteria (1)	. **ACCEPT** below optimum pH	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	An answer that makes reference to three of the following: Similarities • both {are hexoses / have formula of $C_6H_{12}O_6$} (1) • both contain covalent bonds (1) Differences • glucose is a hexagon and fructose is a pentagon (1) • glucose has one CH_2OH and fructose has two (1)	**ACCEPT** have 6 carbons	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	An explanation that makes reference to the following: • as a {respiratory substrate / energy source} for the sperm (1) • because movement (through female genital tract) requires ATP (1) • in order to reduce competition for carbohydrates with the {skin / genital tract} {bacteria / cells} (1)	**ACCEPT** provides energy **NB** ATP must be mentioned at least once for both mps to be awarded **ACCEPT** fructose may not be used by skin cells	(3)

Question Number	Answer	Additional Guidance	Mark
9(a)	An explanation that makes reference to five of the following: • because there would be less water to take up from the soil (1) • therefore there will be fewer {mineral ions / minerals} (transported to the rest of the plant / taken up) (1) • example of a mineral ion deficiency on the plant explained (1) • there will be less water for {photolysis / light-dependent reaction / photosynthesis} (1) • therefore there will be less GALP produced in the {light-independent reaction / Calvin cycle} (1) • therefore less {NPP / plant biomass} (1)	**ACCEPT** plants will {wilt / die} without water **ACCEPT** less glucose produced	(5)

Question Number	Answer	Additional Guidance	Mark
9(b)(i)	• Y calculated (1) • body condition index calculated to 2 dps (1)	<u>Example of calculation:</u> $Y = 0.73 \times 86.4 - 34.5 = 28.572$ $26.4 \div 28.572 = 0.92$ ecf from calculation of Y	(2)

Question Number	Indicative content
***9(b)(ii)**	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. <u>Indicative content</u> • decrease in body mass (D) • therefore decrease in condition index (D / E) • because less nutritious plant material available (E) • decrease in organic matter in stomach (D) • because less plant material available (E) • increase in mineral ion content (D) • because more foraging for roots (E) • and therefore soil is consumed (E) • less water in faeces (D)

	• as plant material does not contain as much water (E) • therefore wombat had to conserve water (E) • 2 months after drought measurements start returning back to normal (D) • as quality and quantity of plant material increases (E) **Level 1 :** 1 mark = 1 description (1 D) 2 marks = 2 descriptions (2 D) or 1 description and 1 explanation (D + E) **Level 2 :** 3 marks = 3 descriptions that include what happens after rain (3D + D) or 2 descriptions and 1 explanations (2D +1E) 4 marks = 2 descriptions and 2 explanations (2D +2E) **Level 3 :** 5 marks = 3 descriptions and 3 explanations (3D +3E) 6 marks = 4 descriptions and 4 explanations that include an explanation of why mineral content in stomach is higher (4D + 4E)

Level	Marks	
0	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation 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 to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.
3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

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