Mark Scheme (Results)

Summer 2023

Pearson Edexcel GCE
In Biology B (8BI0)
Paper 02: Core Physiology and Ecology

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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)	**The only correct answer is D all statements are correct** *A is not correct because statement 3 and 4 are true* *B is not correct because statement 4 is true* *C is not correct because statement 3 is true*	**(1)**

Question Number	Answer	additional guidance	Mark
1(b)	An explanation that includes the following points: • larger organisms have smaller SA/ Vol ratio (1) • some cells far from surface (1) • so diffusion alone cannot supply deliver / transport (oxygen / glucose / nutrients to cells) (1)	**allow converse**	**(3)**

Question Number	Answer	Additional guidance	Mark
1(c)	An answer that makes reference to the following points **Similarities** • both have structures that increase surface area (1) • both have a short diffusion distance (1) • both have surfaces that allow oxygen and carbon dioxide to dissolve (1) **Differences up to three from** • fish live in aquatic environment so do not need to keep surfaces moist / insect air sacs are moist (1) • in insects gases delivered to / removed from cells directly but fish use circulation (1) • fish have gills / lamellae / filaments whilst insects have tracheae/ tracheoles / spiracles (1) • fish have counter current flow (1)	At least one similarity and one difference some insects pump air into and out of trachea some have air sacs which store air	**(4)**

(Total for Question 1 = 8 marks)

estion Number	Answer	Mark
2(a)	**The only correct answer is A lenticels** ***B*** *is not correct because stomata do not allow gases to enter stem* **C** *is not correct because waxy cuticle does not allow gases to enter stem* **D** *is not correct because xylem does not allow gases to enter stem*	**(1)**

Question Number	Answer	additional guidance	Mark
2(b)(i)	• measurement of sides and calculation of area in cm^2 • divided by magnification = actual size of area containing 6 stomata 6 stomata ÷ 0.105 = 57 (per cm^2)	Example of calculation 7.6 × 5.1 = 38.8 cm^2 **allow area from 37.5 to 40.0 (1)** area ÷ 370 **=** 0.105 cm^2 **area ÷370 (1)** **.101 – 0.108** =57 (per cm^2) **allow 55-59** Correct answer with no working gains full marks	**(3)**

Question Number	Answer	additional guidance	Mark
2(b)(ii)	Number of stomata = 57 x 130 (1) or 7410	**allow TE answer to 2bi ×130**	**(1)**

Question Number	Answer	Mark
2(b)(iii)	• Distribution of stomata may not be even / the same across leaf surface / only one sample taken / different parts of the leaf may have different number / rounded to whole number (1)	**(1)**

Question Number	Answer	Mark
2(b)(iv)	An explanation that refers to three of the following points • (plants need to keep stomata open) to absorb carbon dioxide (1) • during the day (1) • for photosynthesis (1) • however having stomata open leads to water loss / transpiration closing prevents water loss (1) • plants need to conserve water to maintain turgor (1)	**(3)** close at night

(Total for Question 2 = 9 marks)

Question Number	Answer	Mark
3(a)	An answer that makes reference to one of the following: • prevents entry of pathogens / named pathogen (1) • prevents blood loss / bleeding (1)	**(1)**

Question Number	Answer	Mark
3(b)(i)	**The only correct answer is D 2, 3 and 4** ***A*** *is not correct because 1 increased levels of high-density lipoproteins does not increase plaque formation and atherosclerosis* ***B*** *is not correct because 1 increased levels of high-density lipoproteins does not increase plaque formation and atherosclerosis* ***C*** *is not correct because 1 increased levels of high-density lipoproteins does not increase plaque formation and atherosclerosis*	**(1)**

Question Number	Answer	Mark
3(b)(ii)	**The only correct answer is B develops in arteries because the blood pressure is higher** ***A*** *is not correct because blood flow is not slower* ***C*** *is not correct because it does not usually occur in veins* ***D*** *is not correct because it does not usually occur in veins*	**(1)**

Question Number	Answer	Mark
3(c)	An explanation that makes reference to four of the following: • so less oxygenated blood to body cells for aerobic respiration (1) • leg movement causes muscles to contract squeezing veins (1) • increases blood flow / allow venous return / blood goes back to heart / blood flow prevents clot developing (1) • if aspirin taken risk of bleeding higher than DVT formation (1) • side effects are worse than risk of DVT / benefits may outweigh the risk (1)	**(4)**

(Total for Question 3 = 7 marks)

Question Number	Answer	Mark
4(a)(i)	**The only correct answer is A Archaea** ***B*** *is not correct because fungi is a kingdom* ***C*** *is not correct because Insecta is a class* ***D*** *is not correct because plantae is a kingdom*	**(1)**

Question Number	Answer	Mark
4(a)(ii)	**The only correct answer is B bacteria** ***A*** *is not correct because animalia are eukaryotes* ***C*** *is not correct because insects are eukaryotes* ***D*** *is not correct because mammals are eukaryotes*	**(1)**

Question Number	Answer	Mark
4(a)(iii)	**The only correct answer is A domain kingdom phylum class order family genus species** ***B*** *is not correct because the order is incorrect* ***C*** *is not correct because the order is incorrect* ***D*** *is not correct because the order is incorrect*	**(1)**

Question Number	Answer	Mark
4(b)	An answer that refers to two of the following • results / data shared with other scientists / published in journal / attend conferences / (1) • that work in same area / field are experts (1) • who confirm / agree with their conclusions / findings (1)	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)	An explanation that includes three of following **Advantages** • new reproductive technologies / breeding programs can maximize the probability of reproductive success / prevent inbreeding (1) • can protect species from poaching / predation so numbers can recover / reintroduce animals back into wild / prevent extinction (1) • educate and raise awareness / raise funds for conservation work (1) **Disadvantages** • can lead to abnormal behaviours / adaptations to captivity / stereotypy (1) • so prevents successful reintroduction (1) • reduces biodiversity of natural habitat / affect food chains in habitat (1)	At least one advantage and one disadvantage	**(3)**

(Total for Question 4 = 8 marks)

Question Number	Answer		Mark
5(a)	An answer that includes four of the following **Similarities** • both haemoglobin and myoglobin are globular proteins (1) • myoglobin and subunits / single chain of haemoglobin have similar secondary and tertiary structure (1) • both contain the oxygen-binding haem / heme (as their prosthetic group). (1) **Differences** • haemoglobin found in red blood cells / myoglobin found in muscle (1) • myoglobin has a higher affinity for oxygen so becomes saturated at lower partial pressures (1) • myoglobin single peptide chain / single haem/ heme chain / haemoglobin 4 peptide chains /4 haem / heme chains / different tertiary / quaternary structure (1)	At least one similarity and one difference	**(4)**

Question Number	Indicative content
5(b)	Answers will be credited according to candidate's 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. **Factor 1 mass of myoglobin in mg g^{-1}** • greater myoglobin longer dive time / less myoglobin shorter dive time • *example of organism from data eg harbour seal has highest myoglobin and longest dive time* **Factor 2 mass** • larger mass organisms do not have relatively longer dive time • *example from data eg larger grey seal has shorter dive time than harbour seal* • as more myoglobin in harbour seal • *water shrew has longest dive time if data adjusted for mass* **Factor 3 habitat** • aquatic organisms have longer dive time / terrestrial have lowest • *example seals have longer dive time* **Factor 4 Relationship between factors habitat and myoglobin** • aquatic organisms have higher myoglobin • *example shrew higher than rat* **Reference to other factors**

	• other named factor such as lung function / evolution / adaptation • *example rat has a relatively long dive time compared to human* • when allowing for body mass **Biological explanation** • more myoglobin allows more storage of oxygen • therefore more aerobic respiration

Level	Mark	Descriptor
	0	No awardable content
1	1-2	The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context. ***Makes reference one or two factors =1*** ***Makes reference to at least one example organism linked to factor = 2***
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of the scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure. ***Makes reference to two factors and includes linked example organism for each =3*** ***Makes reference to three factors and includes linked example organism for each=4***
3	5-6	An explanation is given which is supported throughout by evidence from the analysis, interpretation and/or evaluation of the scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear, coherent and logically structured. ***Makes reference to three factors, examples and includes ref to myoglobin as oxygen store =5*** ***Makes reference to biological explanation link between myoglobin and respiration=6***

(Total for Question 5 = 10 marks)

Question Number	Answer	Mark
6(a)	• P = turgor pressure (1) • π = osmotic potential (1)	**(2)**

Question Number	Answer	Mark
6(b) (i)	• 12	**(1)**

Question Number	Answer	Mark
6(b)(ii)	• points plotted correctly (1) • correct linear axes labelled with units (1) • straight lines joining points / allow line of best fit (1)	**(3)**

Question Number	Answer	Mark
6(b)(iii)	• correct value read of graph at 50% plasmolysis (1) 0.44-0.48	**(1)**

Question Number	Answer	Mark
6(b)(iv)	• corresponding value derived from table / Answer between 0.4 and 0.5 for molarity • units quoted as kPa / kPa **-1130--1460 (1)** **units kPa (1)**	**(2)** **allow 1 mark for answer without units** **units and wrong answer no mark**

Question Number	Answer	Mark
6(c)	An explanation that includes two of the following • At incipient plasmolysis cell wall is not touching cell membrane (1) • so turgor pressure P = 0 (1) • so osmotic potential of cell contents / π = water potential of cell / ψ (1)	**(2)**

(Total for Question 6 = 11 marks)

Question Number	Answer	additional guidance	Mark
7 (a)	An answer that includes • the role of an organism (1) • in its ecosystem / community/ habitat (1)	**ignore environment**	**(2)**

Question Number	Answer	Mark
7 (b)	**The only correct answer is D 1, 2, 3 and 4** ***A*** *is not correct because they are the same* family genus order phylum ***B*** *is not correct because they are same* family genus order phylum ***C*** *is not correct because they are the same* family genus order phylum	**(1)**

Question Number	Answer	Mark
7(c)	An explanation that makes reference to the following points: • a species is (defined as) a group of organisms that interbreed to produce fertile offspring (1) • some are same and some are different species by this definition / partially satisfied by these two closely related flies (1)	**(2)**

Question Number	Answer	Mark
7(d)	An explanation that makes reference to four of the following points: • (some flies settled on Hawaii Island some on Maui) so are geographically isolated (1) • so cannot interbreed / reproductively isolated (1) • no exchange of alleles / genes (1) • so evolve differently subject to different selection pressures (1) • different mutations accumulate and the two species are unable to breed together (1) • called allopatric speciation (1)	**(4)**

Question Number	Answer	Mark
7(e)	A description that makes reference to three of the following points: • look at similarities / differences in anatomical / behavioural / courtship song (1) • use bioinformatics to compare / molecular phylogeny (1) • the DNA sequencing / profiling / DNA barcoding / CBOL/ IBOL (1) • use gel electrophoresis to {compare DNA / amino acids/ proteins} (1)	**(3)**

(Total for Question 7 = 12 marks)

Question Number	Answer	Mark
8 (a)	An answer that makes reference to the following: • can reset bubble on scale (1)	**(1)**

Question Number	Answer	Mark
8 (b)	An explanation that makes reference to two of the following: • increasing fan speed blows away saturated air from stomata / no still air surrounding stomata (1) • so transpiration and water uptake increased as greater/ steeper diffusion / concentration gradient (1) • maximum reached / no further increase from medium to high as all moist air blown away no further increase in gradient (1)	**(2)**

Question Number	Answer	additional guidance	Mark
8 (c)(i)	An explanation that makes reference to two the following: • If leaves are wet (1) • so increases water uptake is lower / transpiration is slower / reduces diffusion gradient (1) or • temperature (increases / decreases) (1) • Increases / decreases kinetic energy of water molecules / water evaporated / water uptake / water loss / transpiration (1) or • cut damages vascular tissue (1) • so less water taken up / lost (1) or • light intensity (increases / decreases) (1) • so stomata open / stomata close (1)	**ignore humidity**	**(2)**

Question Number	Answer	additional guidance	Mark
8 (c)(ii)	An explanation that makes reference to the following: • the lack of an airtight seal (1) • will slow air bubble movement and may stop transpiration / water uptake (1) or • if scale is not read at eye level / read at angle (1) • parallax error in reading bubble on scale (1) or • wider capillary (1) • less distance moved by bubble (1)		**(2)**

Question Number	Answer	additional guidance	Mark
8 (d)(i)	• radius = 0.5 v = 80 • substitute values in formula and calculation • answer given to 2 sig figs = 62 or 63 (3)	full marks for correct answer no working 1 mark for $\times 0.5^2$ or $\times 0.25$ or 1 mark for $\times 80$ if use π as 3.1 = 62 if use π as 3.14= 63 if or 62.8 or 62.84 or 62.832 scores 2	**(3)**

Question Number	Answer	additional guidance	Mark
8 (d)(ii)	An answer that includes • method to measure leaf surface e.g using graph paper (1) • divide water uptake by surface area (1)		**(2)**

Question Number	Answer	additional guidance	Mark
8 (e)	A description that makes reference to three of the following • use at least 5 different temperatures (1) • measure distance moved by bubble in one minute / stated time (1) • repeat for each temperature and calculate mean (1) • use same plant species and size (1) • reference to named control variable light / humidity / wind speed (1)		**(3)**

(Total for Question 8 = 15 marks)