Pearson Edexcel

Mark Scheme (Results)

November 2021

Pearson Edexcel
Advanced Subsidiary in Biology
(8BI0) Paper 02
Core Physiology and Ecology

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November 2021
Question Paper Log Number P67149A*
Publications Code 8BI0_02_2111_MS*
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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible, and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities. Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Mark
1(a)(i)	**The only correct answer is B kingdom** **A** *is not correct because it does not contain the greatest variety of organisms* **C** *is not correct because it does not contain the greatest variety of organisms* **D** *is not correct because it does not contain the greatest variety of organisms*	**(1)**

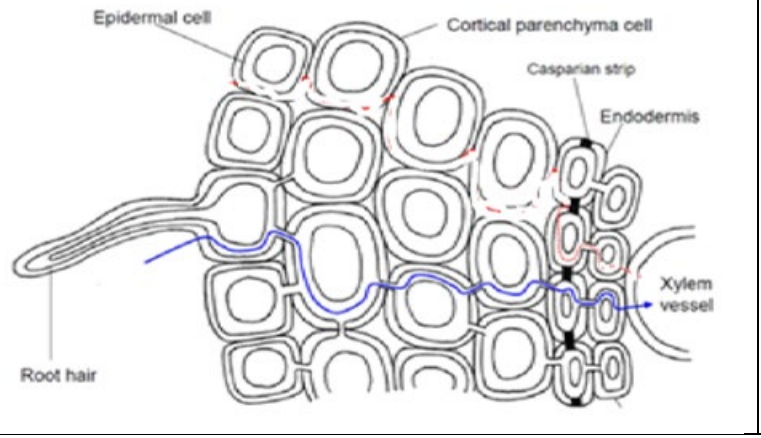
Question Number	Answer Additional guidance	Mark
1(a)(ii)	**The only correct answer is C family** **A** *is not correct because closely related genera are not grouped in a class* **B** *is not correct because closely related genera are not grouped in a domain* **D** *is not correct because closely related genera are not grouped in an order*	**(1)**

Question Number	Answer	Mark
1(a)(iii)	**The only correct answer is D Protista** **A** *is not correct because archaea is a domain* **B** *is not correct because bacteria is a domain* **C** *is not correct because eukarya is a domain*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	An explanation that makes reference to the following points: • used techniques of molecular phylogeny / such as protein biochemistry (1) • which found similarities and differences between archaea and bacteria (1) • **such as** membrane structure, membrane proteins, membrane bound organelles, (1)	allow bioinformatics **examples of evidence** lipid structure, ribosome, plasmids, operons, antibiotic resistance, chloroplasts	**(3)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	• peer reviewed journals / scientific conferences		**(1)**

(Total for Question 1 = 7 marks)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	two marks from • passes from cell cytoplasm to cell cytoplasm (1) • via plasmodesmata of cells (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	• conversion of measurement in mm to µm (x 1000) (1) • and division by 100 (1)	Example of calculation 60 x 1000 ÷ 100 = 600µm Correct answer with no working gains full marks allow 1 mark for 60 x 1000 or ÷ 100	**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)	An explanation that makes reference to **four** of the following: • water is {evaporated / lost / transpired / diffused} from {leaves / stomata} (1) • therefore (leaf) cells have a low water potential / water potential gradient created (1) • because of cohesion of water molecules that {are polar / form hydrogen bonds} (1) • adhesion of water molecules to xylem walls (1)	allow water enters root hair down water potential gradient (1)	**(4)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Additional guidance	Mark
3 (a)(i)	An explanation that makes reference to **two** of the following: • keep air-tight so as to not allow any air bubbles to enter (1) • so that continuous column of water to connect leaves to water in potometer (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
3 (a)(ii)	An explanation that makes reference to **two** of the following • as water on leaves will prevent transpiration / diffusion / evaporation (1) • as no (diffusion / concentration) gradient (1) • as stomata are covered / occluded (by water) (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
3 (b)(i)	An explanation that makes reference to **four** of the following points: • take several readings (at each light intensity) after {stated time period} calculate mean / average (1) • reset using syringe between readings (1) • control named abiotic variable such as temperature / wind / humidity (1) • at 5 different light intensities (1) • vary light intensity by {moving light source away from potometer using light dimmer / rheostat} (1)		**(4)**

Question Number	Answer	Additional guidance	Mark
3 (b)(ii)	An explanation that makes reference to the following: • some water used in photosynthesis (1) • to maintain turgor (1)		**(2)**

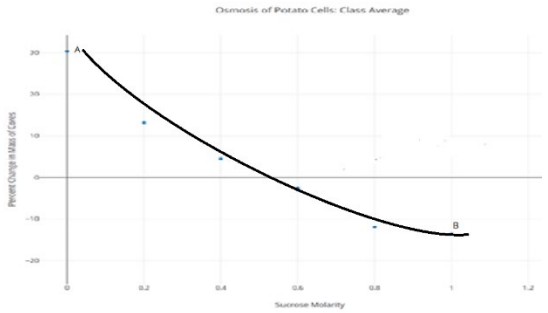
(Total for Question 3 = 10 marks)

Question Number	Answer	Mark
4(a)(i)	**The only correct answer is B endocytosis** ***A*** *is not correct because diffusion does not require energy from respiration* ***C*** *is not correct because facilitated diffusion does not require energy from respiration* ***D*** *is not correct because* osmosis *does not require energy from respiration*	**(1)**

Question Number	Answer	Mark
4(a) (ii)	**The only correct answer is A active transport** ***B*** *is not correct because diffusion is not against a concentration gradient* ***C*** *is not correct because facilitated diffusion is not against a concentration gradient* ***D*** *is not correct because osmosis is not against a concentration gradient*	**(1)**

Question Number	Answer	Mark
4(a)(iii)	**The only correct answer is A active transport** ***B*** *is not correct because diffusion does not show this response to oxygen* ***C*** *is not correct because facilitated diffusion does not show this response to oxygen* ***D*** *is not correct because osmosis does not show this response to oxygen*	**(1)**

Question Number	Answer	Mark
4(a) (iv)	**The only correct answer is B carbon dioxide** ***A*** *is not correct because amino acids cannot enter a cell by diffusion* ***C*** *is not correct because glucose cannot enter a cell by diffusion* ***D*** *is not correct because protein cannot enter a cell by diffusion*	**(1)**

Question Number	Answer	Additional guidance	Mark
4(b) (i)	• a curve or straight line passing through / near all points		**(1)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	• value read from student's graph 0.475-0.575	allow TE from student line	**(1)**

Question Number	Answer	Additional guidance	Mark
4 (b)(iii)	An explanation that makes reference to four of the following points: • water enters cell by osmosis (1) • as water potential of solution higher than ψ / water potential cell (1) • so that P / turgor pressure increases (1) • so ψ water potential cell becomes equal to 0. • until P / turgor pressure equals π / osmotic potential / and opposite (1) • as cell wall prevents further entry of water (1)	increases change in cell osmotic potential negligible	**(4)**

Question Number	Answer	Additional guidance	Mark
4 (b)(iv)	An explanation that makes reference to two of the following points: • cannot measure π / osmotic potential directly as ψ water potential of cell contains both π / osmotic potential and turgor pressure / P (1) • can only be measured by using method of incipient plasmolysis (1) • when ψ = π as P =0 (1)		**(2)**

(Total for Question 4 = 12 marks)

Question Number	Answer	Additional guidance	Mark
5(a)(i)	• **A** atrium (1) • **B** ventricle (1)	allow auricle	**(2)**

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	An answer that makes reference to **three** of the following At least one similarity and one difference Similarities • both have 2 atria (1) • both have AV valves (1) • heart divided into upper and lower chambers / have atria and ventricle (1) Differences • frog has 1 ventricle / undivided whilst mammal has 2 ventricles / has septum (1) • frog has 3 chambers whilst mammal has 4 (1) • frog has no valves in arteries (1)		**(3)**

Question Number	Answer	Additional guidance	Mark
5(b)(i)	• frog systemic circulation contains oxygenated blood from both lungs and skin / in frog blood from ventricle goes to lungs and body (1)		**(1)**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation that makes reference to the following: • low metabolic rate so require less oxygen / lungs allow frogs to be more active on land (1) • so mixing of blood in ventricle not limiting (1) • but blood has to go to two gas exchange surfaces (1) • moist skin allows oxygen to dissolve / skin provides large surface area for gas exchange (1)		**(4)**

Question Number	Answer	Additional guidance	Mark
5 (c)	An explanation that makes reference to **four** of the following: • SAN acts as pacemaker (1) • impulse travels through heart muscle / fibres cause atrial contraction (1) • AVN delays transmission of impulse {to coordinate contraction of ventricle after atria} (1) • impulse spreads through Purkinje / Purkyne fibres via bundle of His (1) • ventricle contracts from apex (1)	initiates depolarization / depolarization starts at SAN	**(4)**

(Total for question 5 = 14 marks)

Question Number	Answer	Additional guidance	Mark
6(a)(i)	• flush out or remove gases from previous trial / allow locust to breathe normal air (1)	allow all locusts to start with same concentration of gases remove carbon dioxide increase oxygen	**(1)**

Question Number	Answer	Additional guidance	**Mark**
6(a)(ii)	• enable breathing (rate) of locust to {recover / return to resting value} (1)	allow return to normal, return to breathing rate in (normal) air	**(1)**

Question Number	Answer	Additional guidance	Mark
6(b)(i)	• $\Sigma (x - x)^2$ (1) • substitution and division (1) • square root to obtain SD (1)	Example of calculation 49 49÷3 =16.33 √16.3 = 4.04 using mean of 48 from table in QP allow 1 mark for dividing by 3 correct answer with no working gets full marks allow SD of 4.03 using mean of 48.25 allow 4.0 (to one dec place as matches other SD data in table)	**(3)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation that makes reference to the following: • as range gets higher so does SD (1) • as both measure dispersal / spread (1)		**(2)**

Question Number	Answer	Additional guidance	Mark
6(c)	An answer that makes reference to the following • as oxygen increases breathing rate fluctuates / no clear relationship (1) • lowest rate at 100% oxygen (1) • as carbon dioxide increases so does breathing rate / highest carbon dioxide breathing rate is highest (1) • carbon dioxide has a greater effect on breathing rate than oxygen (1)	allow converse	**(4)**

(Total for question 6 = 11 marks)

Question Number	Answer	Mark
7(a)(i)	**The only correct answer is A Bohr effect** **B** is not correct because it is not the chloride shift **C** is not correct because it is not the dissociation curve **D** is not correct because it is not the oxygen debt	**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)(ii)	An explanation that makes reference to two of the following: • binding of the first oxygen molecule to haemoglobin changes the shape of haemoglobin molecule (1) • therefore facilitates binding of other oxygen molecules (1)	allow easier faster binding	**(2)**

Question Number	Answer	Additional guidance	Mark
7(a)(iii)	• reading values of graph (1) • calculation (1) 71-51=20%	low carbon dioxide 95-44=51 allow readings 94 or 95 and 44 or 45 so subtraction 49, 50 or 51 high carbon dioxide 87 -16 = 71 allow readings 87 and 16 or 17 so subtraction 70, 71 allow answer 19 or 20 or 21 allow TE for mp 2	**(2)**

Question Number	Answer	Additional guidance	Mark
7(a)(iv)	An explanation that makes reference to three of the following: • as these respiring cells / tissues are releasing are releasing CO_2 (1) • so that haemoglobin has a lower affinity for oxygen (1) • so it unloads its oxygen / dissociates at higher partial pressure of oxygen (1) • thus, more oxygen is released to be used in aerobic respiration (1)	allow haemoglobin is less saturated	**(3)**

Question Number	Answer	Additional guidance	Mark
7(b)	An explanation that makes reference to the following • curve lies to left of normal (1) • therefore haemoglobin has to have a higher affinity for oxygen at lower partial pressures (1)	allow heamoglobin has a higher saturation at lower partial pressures	**(2)**

(Total for question 7 = 10 marks)

Question Number	Answer	Additional guidance	Mark
8(a)	• 13.25 - 12.3 =0.95	allow 0.95 to 1.05	**(1)**

Question Number	Answer	Additional guidance	Mark
8(b)(i)	an answer that includes one of • fertility of males and viability in eggs have a similar temperature range • at low and high temperature eggs are not viable and males are infertile	eggs are viable at same temperature that males are fertile	**(1)**

Question Number	Indicative content
8(b)(ii)	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. **Temp** • viability temperatures are always more extreme than fertility **Obs** • As you can survive but not be able to breed **Conc** Low temp range • *D.melanogaster* cannot survive below 10 ^{o}C **and** *D. simulans* cannot survive below 10 ^{o}C **Obs** • *D.melanogaster* cannot breed below 12 ^{o}C **and** *D. simulans* cannot breed below 11 ^{o}C **Obs** High temp • *D.melanogaster* cannot survive above 32 ^{o}C **and** *D. simulans* cannot survive above 31 ^{o}C **Obs** • *D.melanogaster* cannot breed above 30 ^{o}C **and** *D. simulans* cannot breed above 28 ^{o}C **Obs** • But very similar temperature ranges *D.melanogaster* 12-30 ^{o}C *and D.simulans* 11-28 ^{o}C / **Conc** • Therefore expect to find them in similar locations **Conc**

	Courtship song *D.melanogaster* has shorter pulse interval */ D.simulans* has longer pulse interval **obs** *D.melanogaster* has shorter pulse duration */ D.simulans* has longer pulse duration **obs** differences in courtship song unqualified = one **obs** Species differences in courtship song so females only respond to males of correct species **Conc** Therefore behavioural isolation / causes reproductive isolation **Conc** speciation is sympatric **Conc**

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. ***Gives one observation about temp or courtship =1*** ***Gives one observation and explains one conclusion from temp or courtship or gives two observations from temp or courtship = 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.

		Gives one observation from temp and one from courtship and explains one conclusion=3 ***Gives one observation from temp and one from courtship and gives two conclusions=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. ***Gives two observations from temp and two from courtship and explains all four observations =5*** ***Gives two observations from temperature and two from courtship and explains all four observations and includes suggests (similar) distributions or ranges or identifies sympatric speciation =6***

(Total for question 8 = 8 marks)

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