

Mark Scheme (Results)

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Advanced Subsidiary in Biology

(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.
- 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.

Question Number	Answer	Additional guidance	Mark
1(a)	A calculation which shows: measurement of diameter • conversion of measurement to μm and division of diagram size by actual size • 8750 – 8800 (2)	One mark for correct measurement allow 63 mm or 6.3 cm Example of calculation 63 ×1000 63000÷7.20 = 8750, accept 8800 to 2 sig fig Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	A calculation which shows: • correct substitution of values into formula (1) • calculation of volume (1) = 195.3 μm^3 to 195.5 μm^3 (2)	Example of calculation 4/3 ×3.142 x (3.6×3.6 ×3.6) 4/3 × 3.14 **× 46.656** **Allow 1 mark for** 4/3 × π **× 46.656** **Or 1 mark for 4/3 x 3.142 x 46.656** = 195.33 μm^3 4/3 × 3.143 × 46.656 = 195.52 μm^3 Lots of answers 195.43 Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional guidance	Mark

1(b)(ii)	An explanation that makes reference to three of the following points: • lower volume (for same diameter) / flatter / stacked so (more) can fit through (small) capillaries (1) • higher surface area (/ vol ratio) of red cell so faster / greater / more absorption / diffusion (of oxygen / carbon dioxide / gases) (1) • due to biconcave nature of red cell (curving inwards) (1) • contains heamoglobin (so more able) to **absorb** / **combine / bind with** oxygen / carbon dioxide as (carbaminohaemoglobin or as HCO_3^- ions) (1)	**Smaller so can fit through capillaries** **absorption /diffusion**/ not just transport / carriage	**(3)**

(Total for Question 1 = 7 marks)

Question Number	Answer	Additional guidance	Mark

2 (a)	A description that makes reference to the following: • ethical reasons for maintaining biodiversity (1) • economic reasons for maintaining biodiversity (1)	example of ethical reason such as denying future generations the opportunity to use renewable resources/ genetic resources / aesthetic / maintain gene pool example of ecosystem services: provisioning services such as food clothing , fuel , medicines , building materials / regulating services / removal of toxins supporting services / soil formaton / nutrient recycling / cultural services tourism / allow maintain healthy ecosystem / prevent extinction (accept two ethical or two economic reason)	**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)(i) **CLIP with 2b(ii)**	An answer that includes • calculation of numerator • calculation of denominator • correct calculation of D	Example of calculation 30 x 29 = 870 **870 scores 1 mark** (30 +42+20+56+12)= 160 870 ÷ 160 **÷ 160 scores one mark** D = 5.44 D = 5.4375 Correct answer with no working gains full marks	**(3)**

Question Number	Answer		Mark
2(b)(ii) **CLIP with 2b(i)**	An answer that makes reference to three of the following points: • same number of different species in region A and B (1) • more species evenness / similar relative species abundance in region B (1) • as numbers of each species almost equal (1) • (shown by) D value higher in region B / B more diverse (1)	allow species richness same allow converse for mp 2 3 4	**(3)**

(Total for Question 2 = 8 marks)

Question Number	Answer	Mark
3(a)	**The only correct answer is** C smallest fragment of DNA that travelled the fastest ***A*** *is not correct because it is not the largest fragment of DNA* ***B*** *is not correct because it is not the largest fragment of DNA* ***D*** *is not correct because smallest fragment of DNA does not travel the slowest*	**(1)**

Question Number	Answer	Additional guidance	Mark
3(b)	An explanation that makes reference to three of the following points: • species C (is the most closely related) (1) • as the bands of DNA on the gel most closely match / align with / same pattern (1) • species C has 5 bands in same location (1) • species B has 2 bands and species D has 3 bands (1)	allow converse for least related	**(3)**

Question Number	Answer	Additional guidance	Mark
3(c)	A description that makes reference to **four** of the following: • using information about similar morphology / anatomy (1) • using information about reproduction such as the fertility of hybrids / mate recognition and behaviour (1) • using information about the similarity in proteins / molecular phylogeny (1) • looking at information about ecological niche and where species are found (1) • use of bioinformatics / sequence DNA / sequence amino acid/ use genetic barcodes (1)	allow reference to sexual dimorphism noting that some species male and female have very different morphology allow look up in genetic databases	**(4)**

(Total for Question 3 = 8 marks)

Question Number	Answer	Mark
4 (a)	An explanation that makes reference to the following: • if women smoked they would inhale smoke / would have effects of their own smoking / Co comes from their smoking (1) • so could not attribute changes in babies to effects of passive / separate effect of passive smoking / would not show only the effects of passive smoking / effects of passive smoking would be negligible / masked by own smoking (1)	**(2)**

Question Number	Indicative content
4(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. **Uses data from table** **reference to differences between groups** • (significant) difference in birth weight with higher mean for group not exposed to PS • (significant) difference in birth length with higher mean for group not exposed to PS **but no little difference / similarity in** • but no significant / less difference in head circumference • but no / little difference in apgar scores as much more variation within groups/ higher SD **Comments upon validity / problems with data from table**

	• large study so small differences may be significant • no information upon age / health / mass of mother • no information about how much exposure to PS • unclear pattern as some measures not affected no sig difference **Uses information about effects of CO on haemoglobin** • CO levels many times higher in smokers so also in PS group • as CO absorbed into blood • attaches to Haemoglobin less oxygen carried • oxygen not dissociated or given up in tissues **Effects on baby** • less oxygen available for respiration • less energy for growth • so smaller size **Comments upon problems with information on CO** • no direct physiological measures / oxygen CO levels on mother / baby • no information on effects of substances in PS • no information on persistence of CO in mother's or baby's blood

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 difference or similarity between groups from data in table or effect of CO =1* *Gives one difference or similarity between groups from data in table and one effect of CO = 2* ***or*** *Gives two difference or similarity between groups from data or two effects of CO =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. ***and*** *one effect on baby = 3* ***and*** *two effects on baby = 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. ***and*** *one comment on validity of data or problem with CO information = 5* ***and*** *one comment on validity of data and problem with CO information = 6*

Total for Question 4 = 8 marks)

Question Number	Answer	Mark
5(a)(i)	**The only correct answer is** **C facilitated diffusion** *A is not correct because it does not enter via active transport* *B is not correct because it does not enter via diffusion* *D is not correct because it does not enter via osmosis*	**(1)**

Question Number	Answer	Mark
5(a)(ii)	**The only correct answer is** D 1, 2 and 3 ***A*** *is not correct because statement 1 2 and 3 are correct* ***B*** *is not correct because statement 1 2 and 3 are correct* ***C*** *is not correct because statement 1 2 and 3 are correct*	**(1)**

Question Number	Answer	Mark
5(a)(iii)	**The only correct answer is** **B** a form of active transport in which large particles move out of cells ***A*** *is not correct because it is not transport into cells* ***C*** *is not correct because it is not passive transport* ***D*** *is not correct because it does not passive transport into cells*	**(1)**

Question Number	Answer	Mark
5(b)(i)	An explanation that makes reference to the following: • 60 ^{O}C as it shows the greatest range of absorbance / allow calculation of range (1) • 60 ^{O}C as it has the highest standard deviation (2)	**(2)**

Question Number	Answer	Additional guidance	Mark

5(b)(ii)	A calculation that shows: calculation of numerator divide by 7 calculation of s 0.01852 or 0.0185 or 0.02 scores 3	example calculation allow 1 mark for divide by 7 allow two marks for **0.000343** 0.01852 **Allow full marks for correct answer with no working**	**(3)**

Question Number	Answer	Mark
5(b)(iii)	An explanation that makes reference to three of the following: • as temperature increases the membrane permeability increases gradually then greater after 50^0 C (1) • (gradually at first) due to increased kinetic energy of pigment molecules (1) • as temperature increases the fluidity of membrane increases due to movement of phospholipids/ reduced bonding attraction between phospholipids (1) • (greatest increase above 50^0 C) as then the proteins in cell membrane start to denature and (more) pigment molecules escape (1)	**(3)**

(Total for Question 5 = 11 marks)

Question Number	Answer	Mark
6(a) (i)	• potometer (1)	**(1)**

Question Number	Answer	Mark
6 (a)(ii)	An explanation that makes reference to a pair of the following: • cut shoot (at an angle) under water (1)	**(2)**

	• so that no air enters xylem (1) or • ensure no air is left in capillary tube • so that bubble can move (1) or • seal using petroleum jelly (1) • so that no air leaks into system / make airtight (1) or • move the air bubble to the zero / record the starting position of the air bubble (1) • so that water lost can be accurately measured (1)	

Question Number	Answer	Mark
6 (a)(iii)	An explanation that makes reference to two of the following: • not all water taken up by shoot is lost in transpiration / may absorb more water than it transpires (1) • because some used in photosynthesis / some used in cell expansion / elongation / keep cells turgid (1)	**(2)**

Question Number	Answer	Mark
6 (b)	An answer that makes reference to two of the following: • removing half of the leaves (1)	**(2)**

	• greatest change as decreases by 8 (mm per min) / decreases from 19 to 11 (1)	

Question Number	Answer	Mark
6 (c)(i)	• by putting (transparent) plastic bag / use humidifier / water spray / fan / hairdryer (1)	**(1)**

Question Number	Answer	Additional guidance	Mark
6 (c)(ii)	• change the temperature of the room or use a heater (without affecting other variables) (1)	Not water bath or heat lamp or oven	**(1)**

Question Number	Answer	Additional guidance	Mark
6(c)(iii)	A description that makes reference to the following: • use syringe to deliver (known) volume of water (1) • note how much bubble moves in mm (on scale) (1)	**Allow** note volume of water required (1) to move bubble certain distance (1)	**(2)**

Question Number	Answer	Mark
6(d)	An explanation that makes reference to two of the following points : • increased humidity increases the amount of water (molecules) in the air surrounding stomata (1) • so reduces diffusion gradient / concentration gradient (of water molecules) (1) • so less water loss / transpiration/ less diffusion therefore less water uptake (1)	**(2)**

(Total for Question 6 = 13 marks)

Question Number	Answer	Mark
7 (a)(i)	• separate oxygenated blood from deoxygenated / left side generates a higher pressure for systemic circulation	**(1)**

Question Number	Answer	Mark
7 (a)(ii)	• ventricles have to generate more pressure / pump blood all around body or to the lungs whilst atria collect blood from body / lungs and pump it into ventricles	**(1)**

Question Number	Answer	Mark
7(b)(i)	**The only correct answer is** **A P is the vena cava** B is not correct as Q is pulmonary artery C is not correct because R is the aorta D is not correct because S is the pulmonary vein.	**(1)**

Question Number	Answer	Mark
7(b)(ii)	**The only correct answer is** **B Y closed and Z open** A is not correct as Z is not closed C is not correct as Y is not open D is not correct as Y is not open	**(1)**

Question Number	Answer	Additional guidance	Mark
7(c)	A description that makes reference to **three** of the following: • R / aorta thicker (walls) (1) • R / aorta has a narrower / smaller lumen (1) • R / aorta contains more muscle / elastic tissue (1) • R / aorta contains (semi lunar) valves (1)	allow converse for descriptions of S pulmonary vein. Thicker muscular walls scores mp 1 and 3 allow R more elastic / elasticity	**(3)**

Question Number	Answer	Additional guidance	Mark
7(d) (i)	An answer that makes reference to four from: similarities • both have hearts (1) • both have valves (1) differences • mammals closed system / has blood vessels (1) • mammal have a separate pulmonary circulation system (in insects, exchange of oxygen and carbon dioxide occurs in the tracheal system) (1) • mammal is a double circulatory system and insect is single (1)	accept converse for insect	**(4)**

Question Number	Answer	Additional guidance	Mark
7(d)(ii)	An answer that includes two of the following points : • glucose / amino acids / proteins / mineral ions / lipids / hormones (2)	**https://genent.cals.ncsu.edu/bug-bytes/nutrition/** allow named carbohydrate / named amino acid / named mineral ion	**(2)**

(Total for question 7 = 13 marks)

Question Number	Answer	Mark
8(a)(i)	**The only correct answer is** **B Chordata** A is not correct as Animalia is not a phylum P C is not correct as Eukarya is not a phylum D is not correct as Vertebrata is not a phylum	**(1)**

Question Number	Answer	Mark
8(a)(ii)	**The only correct answer is** ***C*** *Ptilonorhynchus* A is not correct as aves is not a genus B is not correct as bower is not a genus D is not correct as *violaceus* is not a genus	**(1)**

Question Number	Answer	Mark
8(b)(i)	An description that makes reference to the following points : • enables female to judge fitness of male bird (1) • ensures that correct sex / female is courted / mated (1) • ensures that the correct species is courted / mated (1)	**(2)**

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation makes reference to **four** of the following: • (variation in) bower building caused by mutation (1) • males / birds that build (larger bower) attract (more) females / birds that build (more colourful) bower attract (more) females (1) • so more likely to mate / reproduce (1) • therefore pass on <u>alleles / genes</u> (to offspring) (1) • females who mate with successful bower birds more likely to produce offspring (1)	allow produce offspring	**(4)**

Question Number	Answer	Additional guidance	Mark
8(b)(iii)	An answer that makes reference to **four** of the following: • change the colour of feathers or objects (1) • control size / shape / location of bower / size or shape of objects / time of day / season (1) • control presence / absence of male / use same male / use model male bird (1) • count how many female birds visit bower (1) • in stated time (1) • repeat in different areas / repeat with different females (1)	allow idea of females choosing from selection of bowers	**(4)**

(Total for question 8 = 12 marks)