Pearson Edexcel

Mark Scheme (Results)

October 2021

Pearson Edexcel International Advanced Level in In Biology (WBI16/01)
Paper 1: Practical Biology and Investigative Skills

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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)	A description that contains five of the following: • pondweed set up with suitable apparatus to collect gas (1) • use of at least two filters of {different / named} colours or one (coloured) filter and white light (1) • sodium hydrogen carbonate added (in excess) (1) • give pondweed time to acclimatise (1) • volume of gas collected in stated time (1) • identification and control of one variable (1) • repeats and calculate means (to compare) (1)	**Accept** diagram of apparatus **Accept** named wavelengths (instead of colours) eg in the range 480 – 750nm eg 3-30 minutes eg. temperature – eg use a heat shield pH – buffer length of pondweed – measure light intensity – bulb at fixed distance / wattage	**(5)**

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that includes three of the following: • (grana formed from) stacks of membrane (1) • therefore providing large surface area (for photosystems / enzymes) (1) • containing {pigments / named pigments} to absorb light (1) • containing {enzymes / named enzymes} (for light dependent reactions) (1)	**Accept** pigments releasing excited electrons **Accept** containing {electron carriers / electron transport chain} **Accept** enzymes providing {materials / named materials} for the light independent reactions.	**(3)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	An answer that includes: 22.5 breaths per minute (1)	 **Accept** 21 / 24 breaths per minute	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	An answer including the following: • estimation of tidal volume (1) • estimation of respiratory minute ventilation (1)	 **Accept** a value in the range 0.6 – 0.75 **Accept** a value in the range 13.2 – 18.0 (Allow ecf) Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	An explanation including two of the following: • more oxygen is needed for increased (aerobic) respiration (1) • because {muscles / muscle cells} need more {ATP / energy} (for contraction) (1) • because more carbon dioxide ({is being produced by respiration / must be removed}) (1)	**Accept** more oxygen needed for {conversion of lactic acid to pyruvate / oxidation of lactate}	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	An answer including one abiotic and one biotic factor: Abiotic (1) • (room) temperature • humidity • altitude Biotic (1) • {age / sex} of participant • {health / fitness level} of participant • lung capacity • {intensity / duration} of exercise	**Accept** oxygen concentration carbon dioxide concentration **Accept** BMI / smoking	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	An answer that includes the following: • variable with suitable control method described (1) • results are not valid / description of expected effect on the dependent variable (1)		**(2)**

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	An answer that includes the following: • Suitable risk identified (1) • Suitable control identified (1)	Any reasonable risk identified eg slips and trips, animal bites, harm from vegetation, allergies to plants, sunburn, danger from strangers, adverse weather Any corresponding control identified eg suitable footwear, insect repellent, suitable clothing, sunscreen, do not work alone etc	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	An answer that includes the following: There is no (significant) correlation between the mean length of marram grass and position on the dune (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	An answer that includes the following: • axes labelled including units, and linear scale (1) • data plotted correctly in scatter graph format (1)	Mean length (of leaves) /cm and position on dune /m Allow one plotting error	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	An answer that includes the following: • calculation of intermediate step (1) • calculation of r_s (1)	Example calculation **Accept** $\sum d^2 = 8$ **and** n=7 **OR** $\frac{6 \sum d^2}{n(n^2 - 1)} = 0.143 / 0.14$ $r_s = 0.857 / 0.86$ Correct answer with no working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	An explanation that includes two of the following: • correct critical value stated (1) • stated calculated value is greater than the stated critical value, therefore reject the null hypothesis (1) • there is a (significant) correlation between position on dune and (mean) length of leaves (1)	ie 0.786 **Accept** 0.857 > 0.786, so reject the null hypothesis for mp1 and 2 **Accept** stated calculated value is less than the stated critical value, therefore accept the null hypothesis Accept correct statement based on values given for bp2 **Accept** as the position on the dune increases the leaves are longer. **Ignore** any comment on variability of data	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(d)	An answer that includes three of the following: • measure more plants at each position on dune (1) • measure plants at more heights on the dune (1) • use of measuring tape instead of ruler (as some plants are more than one metre long) (1) • suggestion of how to avoid bias when choosing plants or leaves to measure (1)	**Accept** repeat investigation at a different place on dune ie another transect **Accept** repeat on different dunes **Accept** measure more than 10 plants (at each position on dune) **Accept** smaller intervals or to top of dune **Accept** eg random sampling / longest leaf on each plant / other relevant suggestion	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	An answer that includes: • a suitable factor (1)	**Accept** pH / windspeed / soil moisture / soil humus content / salinity / mineral content / water availability	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	A description that includes the following: • use of correct {equipment / method} (1) • standardisation (1) • location of samples (1)	Allow ecf from 3e(i) **Accept** use of probe / meter if appropriate. **Accept** eg collection of soil sample, weighing, heating and reweighing eg sample {at known depth / meter at known height above dune surface} / sample for same time / sample at same time eg sample at {every / each} position on the dune / sample every 2 metres along transect	**(3)**

(Total for question 3 = 16 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that includes three of the following: • find a suitable {concentration / volume} of pineapple juice (1) • find a suitable timescale for growth of bacteria (1) • find a suitable {temperature / pH} for {growth of bacteria / incubation / activity of enzyme} (1) • find a suitable way to count bacteria (1)	**Accept** find a suitable range of concentrations **Accept** find a suitable method of making the pineapple juice **Accept** find storage time (of pineapple juice) which has an effect **Accept** identify suitable growth medium **Accept** find a suitable method for comparing growth (rate)	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that includes eight of the following: • clear statement of the dependent variable (1) • method of producing pineapple juice (1) • (use of nutrient broth) with and without pineapple juice (1) • use of aseptic technique (1) • samples taken at suitable intervals (1) • suitable method for counting bacteria (1) • method of calculation of growth rate (1) • identify one variable to be controlled and description of how it is controlled (1) • identify second variable to be controlled and description of how it is controlled (1) • repeats for each set up or repeat the whole investigation (1)	**Accept** {number of bacteria / turbidity / absorbance} with ref to time **Accept** heated juice / water / sugar solution as a control **Accept** several concentrations of juice as long one is zero. **Accept** comparison of fresh and stored eg flaming neck of bottles, work near Bunsen burner etc **Accept** bacteria counted at start and after suitable time **Accept** {absorbance / transmission} with {colorimeter / datalogger} **Accept** serial dilution and plating **Accept**: temperature, pH, {age / variety / part / tissue} of pineapple, {concentration / volume} of juice, {age / volume / concentration} of bacterial culture {composition / concentration / volume} of growth medium	**(8)**

Question Number	Answer	Additional Guidance	Mark
4(c)	An answer that includes the following: • raw data table with headings and appropriate units, with means calculated from repeats (1) • graph with both labelled axes (1) • use of an appropriate statistical test (1)	**Accept** description of calculating mean	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(d)	An answer that includes three of the following: • {clumping / uneven distribution} of bacteria makes it difficult to count (1) • factors related to colorimeter use (1) • relevant named factor may affect growth (rate) of bacteria (1) • second relevant named factor may affect growth (rate) of bacteria (1)	**Accept** hard to add the same number of bacteria to each culture at the start **Accept** factors related to serial dilution and plating (1) **Ignore** pH and temperature	**(3)**

(Total for question 4 = 17 marks)

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