Mark Scheme (Results)

January 2023

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

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:
	
	• clear statement of the dependent variable (1)
	
	• use of five different concentrations (1)
	
	• plants set up with suitable apparatus (to enable counting leaves/collecting plants) (1)
	
	• For a (stated/same) time
	
	• identification and control of one variable (1)
	
	• repeats and calculate means (to compare) (1)
	
	• description of calculation of rate (1)
		Eg (counting) number/mass of plants/leaves
		Ignore rate.
		Units not needed
		
		Eg petri dish/beaker (so plants can be counted/find mass) not test tube
		
		minimum 1 day
		
		Accept:
		     Temperature – thermostatic water bath /AC/incubator pH – buffer
		     light intensity – bulb at set distance
		eg to find variability/SD
		
		not mean rate
		
		eg number/mass of plants/leaves/leaflets divide by time
			(6)

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that includes three of the following: • nitrogen used to form chlorophyll (1) • to form {amino acids/ proteins} (1) • (for) enzymes (1) • to form {nucleotides / RNA / DNA/ribosomes} (for the synthesis of chromosomes) (1) • to produce a named {protein/ organelle/membrane} involved in cell division (1)	Accept relevant named enzyme accept ATP/other organic compounds that can be formed e.g. tubulin/spindle fibres	**(3)**

(Total for Question 1 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)	Emphasis is on risk to **humans** • suitable risk identified (1) • suitable control of risk (1)	e.g. harmful bacteria /infection/pathogens/biohazard not contamination unqualified e.g. good aseptic technique /specific example e.g. limited lifting of lid/gloves/incubate below body temperature ignore allergies	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	Suitable working shown • correct of log 10 values (1) • correct of denominator (1) • correct answer to three sig figs (1)	ECF for MP2 and 3 4.15 & 2.95 0.602 (allow 0.301x2) 1.99 / 1.98 **Correct answer (1.99/1.98) without working 3 marks** Allow one mark only either for $\log_{10} 14000 - \log_{10} 900$ divided by 0.301x2 **OR** just 0.301x2 Allow 2 marks for a correct answer with the wrong sig figs and no working e.g. answer 1.986	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	Any two from Abiotic • temperature • pH • oxygen • growth medium	Mark the first answer on each line Unless the second answer on a line is a biotic factor (negates)	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	• variable with suitable control method described ; • results are **not** valid / description of expected effect on the dependent variable ;	An inappropriate biotic/abiotic variable can still gain both marks E.g. incubator/AC/Thermostatically controlled waterbath Accept reduced validity	**(2)**

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)	There is no (significant) difference between the (mean) time before **extension** in mud and sand (habitat)	Accept equivalent correct answers Eg time to re-emerge/ different substrates	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• suitable table with correct raw data (1) • with headings with units (1) • correct means (1)	**MP1 do not accept an extra column** **Time before extension /s** <table><tr><td>Mud (habitat)</td><td>Sand (habitat)</td></tr><tr><td>14.8</td><td>14.0</td></tr><tr><td>8.2</td><td>7.4</td></tr><tr><td>9.9</td><td>9.2</td></tr><tr><td>11.6</td><td>12.6</td></tr><tr><td>12.0</td><td>10.7</td></tr><tr><td>14.2</td><td>7.8</td></tr><tr><td>10.7</td><td>8.0</td></tr><tr><td>11.2</td><td>11.1</td></tr><tr><td>8.9</td><td>10.7</td></tr><tr><td>12.1</td><td>10.8</td></tr><tr><td>12.9</td><td>11.2</td></tr><tr><td>Mean 11.5</td><td>Mean 10.3</td></tr></table> Means must be to the same number of decimal places	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	• axes labelled including units, and linear scale starting at zero without a break (1) • data plotted correctly in bar graph format (1) • range bars correctly plotted (1)	**Mean** time (for extension) /s mud sand Ignore line if drawn Mean 11.5 10.3 Range mud 8.2 -14.8 sand 7.4 - 14	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	• correct numerator (1) • correct denominator (1) • correct answer (1)	Allow ECF if incorrect mean values used for MP2 and 3 1.2/1.182 0.763 /0.873 1.37 /1.35 Correct answer gains 3 marks Correct substitution into formula gains one mark instead of mps 1 and 2	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	• the critical value is **2.09** (1) • calculated value is less than the critical value, therefore accept the null hypothesis (1) • there is no (significant) difference between the **extension** time for mud and sand animals (1) • comment on variability of data (1)	Accept ECF for calculated values greater than 2.09 Followed by logical statements Accept there is a difference if they have rejected null hypothesis Eg range bars overlap	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(d)	An answer that includes two of the following: • opsin changes when stimulated by {light/photon} / changes retinal from cis to trans / a different isomer (1) • causes an {action potential/impulse} (in sensory) nerve (1) • causing a reflex response (1)	Ignore refs to rhodopsin Accept descriptions leading to hyperpolarisation Accept muscle contraction/reflex action	**(2)**

(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 method of identifying this species (1) • find a suitable method to stimulate grasshopper movement (because they are camouflaged) (1) • find the time of day/month the grasshoppers are (most) active (1) • find a suitable {sampling/counting} method (1) • find suitable weather conditions (1)	Accept the best time of day/month to do the study E.g. suitable methods - transects/size of quadrat/capture and release/nets /how to measure the grasshopper population	**(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 standardised sample sites (of known area on both sites) (1) • standardised {method/time} of counting on both sites (1) • identify two variables to be monitored (1) • Describe how one variable can be {monitored/controlled} (1) • repeats for {one/either} sample area (1) • repeat the whole investigation at different times of year (between November and March) (1) • method of calculation of population density (1)	Eg number of grasshoppers per unit area Allow use of nets/quadrats/camera suitable way to mark/recapture grasshoppers /Lincoln index Accept control Eg temperature, light(intensity) , humidity, rainfall, pH, time of day, weather use similar aspect/slope of road and gravel area Accept different days	**(8)**

Question Number	Answer	Additional Guidance	Mark
4(c)	• raw data table with headings and appropriate units, with means calculated from repeats (1) • bar graph with labelled axes (1) • use of an appropriate statistical test for difference (1)	**Accept** any headers with units **Accept** description of calculating mean **Do not accept** units in the body of the table Accept labels on graph from table	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(d)	An answer that includes three of the following: • difficulty in identifying this species (1) • difficulty in seeing/making grasshopper move. (1) • difficult to ensure each grasshopper counted is a new individual (1) • difficult to {measure/monitor} a named variable (1) • Sampled once so population may change over time	Accept rare/hard to find Accept hard to catch them Accept cannot/difficult to control Accept can only be sampled once as they are endangered	**(3)**

(Total for question 4 = 17 mark