



Mark Scheme (Results)

January 2021

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

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Publications Code WBI16_01_2101_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.

Question Number	Answer	Additional Guidance	Mark
1a	<p>A description that includes six of the following points:</p> <ul style="list-style-type: none"> • (compare) pollen grains with and without stigma extract • method of measuring growth of pollen tube (1) • identification of one variable with suitable method of control (1) • identification and method of control of a second variable (1) • stated time (intervals) for measuring length of pollen tube (1) • method for calculating rate of growth (1) • repeats (for each treatment) and calculate a mean (1) 	<p>Accept with extract and with sucrose as control Accept different concentrations of extract as long as one is zero</p> <p>Need to mention microscope Accept use of rule, squared paper, stage micrometer</p> <p>Accept {temperature / pH / volume of water / light intensity / age of plant / age of pollen grains / time after ripening of stamens, Ignore size of pollen grains</p> <p>Accept measure after a single suitable interval eg after 30 mins min, max 12 hours; or at suitable intervals eg 10-30 mins</p> <p><u>Change in length</u> time</p> <p>Accept repeats and calculate SD</p>	6

Question Number	Answer	Additional Guidance	Mark
1(b)	<p>A description that includes four of the following:</p> <ul style="list-style-type: none"> starch is {digested / broken down / hydrolysed} to release glucose (1) condensation reactions are used to form pectin (1) pectin {secreted into / enclosed in / transported in} vesicles (1) vesicles fuse with the {tip / cell membrane} to release {pectin / contents} (1) (respiration in) mitochondria releases {ATP / energy} for production of {vesicles / pectin / enzymes / other relevant molecules} (1) 	<p>Accept release monosaccharides</p> <p>Accept glucose joined by glycosidic bonds to form pectin/polysaccharide</p> <p>Accept reference to exocytosis releasing contents</p> <p>Accept energy used for movement of vesicles / exocytosis</p> <p>Piece together mp5</p>	4

Question Number	Answer	Additional Guidance	Mark
2 ai	<ul style="list-style-type: none"> calculation of mean distance (1) correct use of r^2 (1) correct answer (1) 	<p>Allow ECF for MP2 and MP3</p> <p>$L = 4.4$ (mm)</p> <p>$r^2 = 0.01$ (mm²)</p> <p>0.14 (mm³ min⁻¹)</p> <p>0.138 gets 2 marks</p> <p>correct answer with no working gains (3) marks</p>	3

Question Number	Answer	Additional Guidance	Mark
2aii	<ul style="list-style-type: none"> • <u>volume of carbon dioxide produced</u> (1) volume of oxygen used • RQ value calculated (1) 	<p>0.11 ÷ 0.14</p> <p>0.786/0.79 / 0.8/0.80</p> <p>Allow ecf of wrong rate of oxygen from 2ai</p> <p>0.11 ÷ 0.138 = 0.797 / 0.80</p> <p>0.11 ÷ 0.55 = 0.20</p>	2

Question Number	Answer	Additional Guidance	Mark
2aiii	<ul style="list-style-type: none"> • soda lime absorbs carbon dioxide so must be removed so carbon dioxide produced can be measured. 	<p>Accept glass beads do not absorb carbon dioxide so carbon dioxide produced can be measured</p> <p>Ignore ref to measuring RQ</p>	1

Question Number	Answer	Additional Guidance	Mark
2bi	<p>An answer that includes two of the following:</p> <ul style="list-style-type: none"> • mass of maggot (1) • species (1) • age (1) 	<p>One abiotic and two biotic = 1mk</p> <p>two abiotic =0</p> <p>Accept source</p> <p>Ignore size, sex, type, genetic variation, microbes in tube, competition, disease</p>	2

Question Number	Answer	Additional Guidance	Mark
2bii	<p>A description that includes the following:</p> <ul style="list-style-type: none"> variable with suitable control method described (1) results are not valid / description of expected effect on the dependent variable (1) 	<p>Must give detail not just eg use the same mass</p> <p>Must be directional if giving expected effect</p>	2

Question Number	Answer	Additional Guidance	Mark
3a	<ul style="list-style-type: none"> there is no (significant) difference between the (mean) diameter of the zone of inhibition between samples from village B and village A 	<p>Three parts to this answer: can be expressed in many different ways</p>	1

Question Number	Answer	Additional Guidance	Mark																																				
3bi	<ul style="list-style-type: none"> suitable table format with data (1) correct column headings with units (1) means correctly calculated to same number of places as data table (1) 	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2" style="text-align: center;">{Diameter / length} of zone of inhibition /mm</th> </tr> <tr> <th style="text-align: center;">Village A</th> <th style="text-align: center;">Village B</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">15.9</td><td style="text-align: center;">17.2</td></tr> <tr><td style="text-align: center;">16.2</td><td style="text-align: center;">17.0</td></tr> <tr><td style="text-align: center;">14.5</td><td style="text-align: center;">17.3</td></tr> <tr><td style="text-align: center;">17.1</td><td style="text-align: center;">15.8</td></tr> <tr><td style="text-align: center;">15.3</td><td style="text-align: center;">17.3</td></tr> <tr><td style="text-align: center;">15.4</td><td style="text-align: center;">18.9</td></tr> <tr><td style="text-align: center;">16.2</td><td style="text-align: center;">19.1</td></tr> <tr><td style="text-align: center;">16.8</td><td style="text-align: center;">19.3</td></tr> <tr><td style="text-align: center;">14.4</td><td style="text-align: center;">16.9</td></tr> <tr><td style="text-align: center;">16.8</td><td style="text-align: center;">14.8</td></tr> <tr><td style="text-align: center;">18.2</td><td style="text-align: center;">16.7</td></tr> <tr><td style="text-align: center;">16.1</td><td style="text-align: center;">17.4</td></tr> <tr><td style="text-align: center;">16.9</td><td style="text-align: center;">17.8</td></tr> <tr><td style="text-align: center;">16.6</td><td style="text-align: center;">17.4</td></tr> <tr><td style="text-align: center;">16.4</td><td style="text-align: center;">16.8</td></tr> <tr> <td style="text-align: center;">Mean</td> <td style="text-align: center;">16.2 17.3</td> </tr> </tbody> </table>	{Diameter / length} of zone of inhibition /mm		Village A	Village B	15.9	17.2	16.2	17.0	14.5	17.3	17.1	15.8	15.3	17.3	15.4	18.9	16.2	19.1	16.8	19.3	14.4	16.9	16.8	14.8	18.2	16.7	16.1	17.4	16.9	17.8	16.6	17.4	16.4	16.8	Mean	16.2 17.3	3
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Question Number	Answer	Additional Guidance	Mark
3bii	<ul style="list-style-type: none"> bar graph with linear scale, correct axis labels including units (1) means plotted correctly (1) range bars plotted correctly (1) 	<p>Mean diameter of zone of inhibition (mm) and bars labelled A and B</p> <p>Accept broken scale</p> <p>16.2 and 17.3 ALLOW ecf from 3bi</p> <p>A 14.4 to 18.2 B 14.8 to 19.3</p>	3

Question Number	Answer	Additional Guidance	Mark
3biii	<ul style="list-style-type: none"> correct calculation of numerator (1) correct substitution of given $\frac{(S_A)^2}{n}$ and $\frac{(S_B)^2}{n}$ (1) correct answer (1) 	<p>Example of calculation</p> <p>$17.3 - 16.2 = (-) 1.1$</p> <p>Accept $17.31 - 16.19 = 1.12$</p> <p>$\frac{0.99}{15} + \frac{1.39}{15}$</p> <p>$t = 2.76$</p> <p>Accept $- 2.76 / 2.81 / - 2.81$</p> <p>Allow mp 2 and 3 only if incorrect means used</p> <p>correct answer with no working gains (3) marks</p>	3

Question Number	Answer	Additional Guidance	Mark
3biv	<p>An answer that includes the following:</p> <ul style="list-style-type: none"> • t value greater than critical value so {difference is significant / reject the null hypothesis} (1) • Bacteria from village A are (significantly) more resistant to ampicillin than bacteria in village B (1) • Cannot comment on development of resistance in village B as do not have any data to compare {before ampicillin given / with another village where ampicillin has not been given} (1) 	<p>Accept correct numbers $2.76 > 2.05$ Ref to correlation & difference = no mark</p> <p>Accept appears that resistance has developed in village A (as ZOI is significantly bigger)</p> <p>Accept that bacteria in village B have not developed resistance compared to bacteria in village A</p>	2

Question Number	Answer	Additional Guidance	Mark
3c	<p>An answer that includes two of the following:</p> <ul style="list-style-type: none"> • more samples from each village (1) • compare with villages not using {antibiotic / ampicillin} (1) • control of biotic factors (1) 	<p>Accept repeat the study / larger sample size / samples from more villages</p> <p>eg {age / variety / species / diet / spacing} of chickens</p> <p>Ignore reference to genetic variation in chickens / mass / gender</p> <p>Ignore reference to testing different concentrations of ampicillin</p>	2

Question Number	Answer	Additional Guidance	Mark
4a	<p>A description that includes three of the following:</p> <ul style="list-style-type: none"> • find a suitable concentration range for ABA (1) • find a suitable method for measuring starch digestion (1) • find a suitable {temperature/pH} (for starch digestion) (1) • find a suitable timescale (for starch digestion) (1) 	<p>Accept suitable concentrations of ABA</p> <p>Accept suitable method for measuring amylase production</p> <p>Accept species (of wheat)</p> <p>Accept find a suitable time for soaking endosperm in ABA (1)</p>	3

Question Number	Answer	Additional Guidance	Mark
4b	<p>An answer that includes eight of the following:</p> <ul style="list-style-type: none"> • clear statement of the dependent variable e.g. size of clear area (1) • some description of aseptic technique e.g. rinse endosperm in {sodium hypochlorite/sterile water} (1) • soak the endosperm with ABA and place on starch agar (1) • stated time for incubation 24-72hrs (1) • method of determining clear area e.g. trace for total area or take (several) diameter measurement(s) (1) • identify one variable to be controlled and description of how this variable is controlled (1) • identify second variable to be controlled and description of how this variable is controlled (1) • repeats at each ABA concentration or repeat the whole experiment (1) • test at 5 different concentrations of ABA (1) 	<p>Accept absorbance / transmission using colourimeter</p> <p>Accept using disinfectant (of wheat or apparatus, but not bench)</p> <p>Accept place endosperm in tube containing starch solution</p> <p>Accept use colorimeter to measure {transmission / absorbance} (if starch in tube method used)</p> <p>Accept pH temperature humidity light intensity species / variety, age of seed, mass / size of seed</p>	8

Question Number	Answer	Additional Guidance	Mark
4c	<ul style="list-style-type: none"> raw data table with headings and means calculated from repeats (1) line graph format with labelled axes (1) use of an appropriate statistical test (1) 	<p>Accept any header with units even if incorrect Accept description of calculating mean Do not accept units in the body of the table</p> <p>Accept scatter graph</p> <p>Accept correlation test or named correlation test</p>	3

Question Number	Answer	Additional Guidance	Mark
4d	<ul style="list-style-type: none"> difficult to measure small clear areas (1) difficult to maintain aseptic conditions (1) {growth regulators / chemicals} in seed may affect amylase production 	<p>Accept difficulty in using the colourimeter or judging an end point</p> <p>Accept {seeds / agar} may be contaminated with bacteria</p> <p>Accept genetic variation in seeds affects {amylase production / size of endosperm}</p>	2

