Pearson Edexcel

Mark Scheme (Results)

October 2022

Pearson Edexcel International Advanced Subsidiary In Biology (WBI16)
Paper 1: Practical Biology and Investigative Skill

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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 measure volume of gas (1) • use of at least five appropriate (stated) temperatures (1) • time for pondweed to acclimatise • sodium hydrogen carbonate added (in excess) (1) • volume of gas collected in {same/stated} time (1) • identification and control of one variable (1) • method of calculating rate (1)	**Accept** name of apparatus eg photosynthometer**/** diagram of apparatus to measure volume eg funnel +tube +(gas)syringe (connected together) Within range 5 - 50˚C **Accept** correct formula/bicarbonate/potassium hydrogen carbonate **Accept** minutes/hours/ per unit time **Accept:** pH – buffer mass or length of pondweed – measure light intensity – bulb at set distance – heatshield – wavelength with lamps/filter **Accept** number of bubbles divided by time	**Exp (5)**

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that includes three of the following: • water (split to) form oxygen (1) • by photolysis (1) • electrons removed from water (1) • two oxygen (atoms) combine to form {one oxygen **molecule/O_2**} (1)	Ignore light dependent reaction unqualified Accept equation for MP1 and 3 $H_2O \rightarrow 2H^+ + 2e^- + ½ O_2$ to produce hydroxides/OH^- hydroxides react to form water and oxygen	**Exp (3)**

(Total for Question 1 = 8 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	• (add) {0.004 g/4mg} in 20 cm^3 of water	**Accept** equivalent correct answers e.g. 4mg in 0.02dm^3 Or 200mg in1dm^3 and then remove 20cm^3	**Exp (1)**

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	0.93	Accept 0.933/0.9 Ignore 0.93333/0.93·	**(1)** **Exp**

Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	56.99	ECF from part ii Allow 55.55 to 57.127/57.13 Max 3 decimal places	**Exp (1)**
Question Number	Answer	Additional Guidance	Mark
2(a)(iv)	An explanation including two of the following: • facilitated diffusion (down a concentration gradient) (1) • (concentration) gradient reduces over time (1)	Accept description e.g. channel proteins Accept description of gradient and time refs using 1 - 2 hrs and 4 - 5hrs	**Exp (2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	Abiotic • temperature • pH Biotic • age / sex of toad • {part of body providing skin sample/thickness of skin}	Ignore other abiotic factors **Accept** gender **Accept** disease If biotic and abiotic factor stated on the same line they negate each other	**Exp (2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	An answer that includes two of the following: • variable with suitable control method described (1) • results are not valid / description of expected effect on the dependent variable (1)	**Accept** AC / incubator/thermostatically controlled waterbath **Accept** stated directional answer	**Exp (2)**

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• suitable risk identified (1) • suitable control identified (1)	Any reasonable risk identified eg toxic effects, allergy, irritant **ignore** infection/labcoat/PPE Any corresponding control identified eg use of gloves/mask	**Exp (2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	• there is no (significant) correlation between the (mean) percentage of germination (after 4 days) and the concentration of arsenic ions		**Exp (1)**

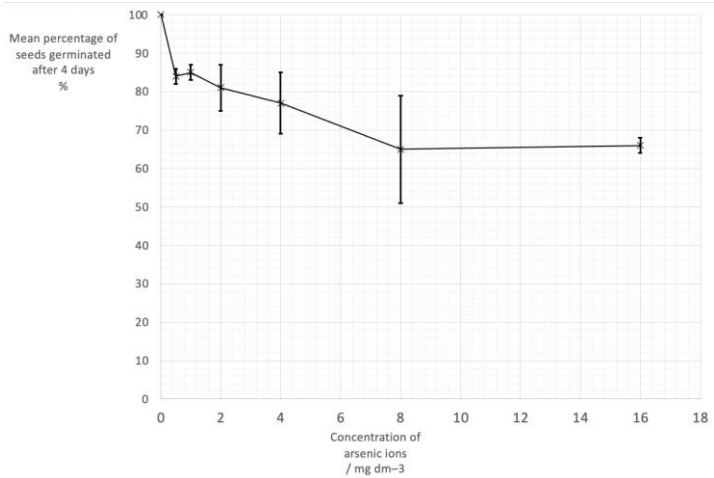
<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>3(a)(iii)</td>
<td>An answer that includes three of the following:

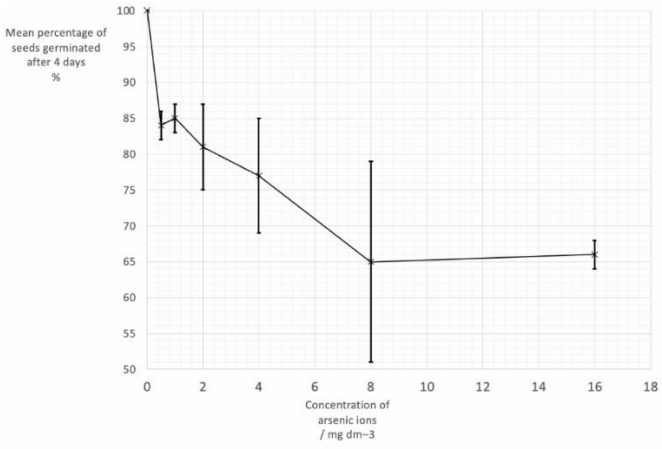
• axes labelled including units (1)

• data plotted correctly on a linear scale in scatter graph format (1)

• error bars correctly plotted (1)

<table>
<tr><th>concentration /mg dm^{-3}</th><th>mean %</th><th>error bar</th></tr>
<tr><td>0.0</td><td>100</td><td></td></tr>
<tr><td>0.5</td><td>84 ± 2</td><td>82 - 86</td></tr>
<tr><td>1.0</td><td>85± 2</td><td>83 - 87</td></tr>
<tr><td>2.0</td><td>81± 6</td><td>75 - 87</td></tr>
<tr><td>4.0</td><td>77 ± 8</td><td>69 - 85</td></tr>
<tr><td>8.0</td><td>65 ±14</td><td>51 - 79</td></tr>
<tr><td>16.0</td><td>66 ± 2</td><td>64 - 68</td></tr>
</table>
</td>
<td>Accept y axis mean % germination and x axis concentration of arsenic ions/ mg dm^{-3}
Accept broken scale with symbol or scale not starting at zero Ignore line if drawn

Example graph

</td>
<td>Exp (3)</td>
</tr>
</table>

		Example graph y axis not at zero  	

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	• calculation of intermediate step (1) • calculation of r_s (1)	**Accept** $\sum d^2 = 24$ **and** n=7 **OR** $\frac{6\sum d^2}{n(n^2-1)} = \frac{24}{336}$ 13/14 r_s = 0.929 / 0.93 / 0.9/0.9286 must be correct rounding correct answer with no working gains full marks	**Exp (2)**

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	An answer that includes three of the following: • calculated value (0.93) is greater than the critical value, **0.786** therefore reject the null hypothesis (1) • there is a (significant) correlation between the percentage germination and the concentration of arsenic ions (1) • comment on variability of data (1)	**Accept** 0.93 > 0.786, so reject the null hypothesis **Accept** critical value identified in table only **Accept** a correct statement using the critical value from p = 0.01 **Accept** converse wording for MP1 And 2 if they claim the calculated value is less than.... Eg error/range bars **overlap**	**Exp (3)**

Question Number	Answer	Additional Guidance	Mark
3(c) (i)	An answer that includes two of the following: • differences in {alleles/DNA} (may alter the response to arsenic ions) (1) • some varieties may be unable to <u>absorb</u> arsenic ions (during germination/in 4 days) (1) • reference to mutation/natural selection (1)	Ignore genes **Accept** comment on membrane permeability **Accept** details of one form of mutation	**Exp (2)**

Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	An answer that includes three of the following: • germinate seeds with no arsenic (1) • (grown in) different concentrations of arsenic ions (1) • control of a stated condition (1) • measure {height/mass} of plants after {stated/same length of time} (1)	Ignore soil Eg temperature, volume of water, light , pH accept other suitable parameter eg 7-100 days	**Exp (3)**

(Total for question 3 = 16 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that includes three of the following: • find the time for animal to start feeding (1) • find a suitable conditions for the animal to feed (1) • find a suitable method to for applying a touch/ suitable force (1) • find a suitable method of determining/measuring the extent of fan withdrawal (1)	Find/determine / identify eq Do not award method statements **Accept** find time interval between touches **Accept** measuring extension	**Exp (3)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that includes eight of the following: • clear statement of the dependent variable (1) • allow animal to acclimatise • method of touching the animal (1) • stated time intervals between touches or stated number of touches in a set time (1) • supply of organic particle to stimulate feeding activity (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 • repeat with another animal (1)	**Accept** record the length /extent of the withdrawal E.g. use of glass rod/cotton bud / touch with the same force MP6 and 7 e.g. temperature with thermostat in tank/waterbath **Accept** same age/sex	**Exp (8)**
Question Number	Answer	Additional Guidance	Mark

4(c)	• raw data table with headings and units, with means calculated from repeats (1) • scatter/line graph with labelled axes (1) • use of an appropriate (statistical) correlation test (1)	**Accept** any headers with appropriate units **Do not accept** description of calculating mean **Do not accept** units in the body of the table Accept bar graph and t test if comparing just two treatments	**Exp (3)**

Question Number	Answer	Additional Guidance	Mark
4(d)	An answer that includes three of the following: • difficulty in determining extent of withdrawal (1) • difficult to determine same pressure/force of touch (1) • difficult to ensure each organism in the {same age /not already habituated} (1) • difficult to control concentration of organic particles (1)	**Accept** noise/vibration/water currents/light to shade	**Exp (3)**

(Total for question 4 = 17 marks)

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