



# Cambridge Pre-U

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**BIOLOGY**

**9790/02**

Paper 2 Data Analysis and Planning

**For examination from 2020**

MARK SCHEME

Maximum Mark: 60

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**Specimen**

This specimen paper has been updated for assessments from 2020. The specimen questions and mark schemes remain the same. The layout and wording of the front covers have been updated to reflect the new Cambridge International branding and to make instructions clearer for candidates.

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This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document has **8** pages. Blank pages are indicated.

**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

The following abbreviations may be used in mark schemes:

/	alternative and acceptable answers for the same marking point
;	separates marking points
allow/accept/A	answers that can be accepted
AVP	any valid point – marking points not listed on the mark scheme but which are worthy of credit
AW/owtte	credit alternative wording /or words to that effect
ecf	error carried forward
ignore/I	statements which are irrelevant – applies to neutral answers
max	indicates the maximum number of marks
not/reject/R	answers which are not worthy of credit
ORA	or reverse argument
(words)	bracketed words which are not essential to gain credit
<u>words</u>	underlined words must be present in answer to score a mark

**Section A**

Question	Answer	Marks
1(a)(i)	1016 ;	<b>1</b>
1(a)(ii)	<p><b>max 3 for comments on accuracy from:</b>            numbers of marked fish recaptured in, 2003/2004, are small ;            estimates based on small numbers are unlikely to be accurate ;            over a hundred/many, very young eels caught and not marked ;            proportion of those not marked increases from 2000 to 2005 ;            total number of fish caught one year on is not adjusted for very young fish ;            so population is underestimated ;            AVP ;</p> <p><b>max 3 for comments on limitations from:</b>            marking may injure animal ;            alters behaviour/makes it prone to predation/less able to feed/AW ;            marks may be lost ;            chances of catching fish may vary if marked ;            chances of catching fish vary with their age ; <b>A</b> 'trap happy' / 'trap shy'            some fish easier to catch than others ;            fish unlikely to mix thoroughly in streams ;            activity of fish may depend on, environmental conditions/AW ;            effect of deaths ;            effect of migration, into/out, of streams ;</p> <p>effect of any named limitation giving, underestimate / overestimate, of population size ;</p> <p>AVP ;</p>	<b>6</b>
1(b)(i)	most increase in, length/mass, in 2003–2004 ; wide range of results ; especially for increase in mass ; median increase in mass remained roughly constant (except for 2003–2004) ; comparative data quote ; AVP ; <b>max 3</b>	<b>3</b>
1(b)(ii)	(box-whisker plot) gives more information about the range of results in a sample ; position of median, shows skewness of data/AW ; does not display outliers/anomalous results ; useful if data are not normally distributed ; easier to compare data from different categories than using bar charts ; AVP ; <b>max 3</b>	<b>3</b>

Question	Answer	Marks
1(c)	no data on migration to and from the sea ; no information on reproduction of eels ; data is only about eels, not about food supply/habitat/niche/AW ; no information on age structure ; no standard against which to compare data on growth ; no information on likely causes of death ; no information on, behaviour/movement, of eels during each year ; AVP ; AVP ; <i>max 4</i>	<b>4</b>

Question	Answer	Marks
2(a)	majority/most, pollen released between midnight and midday/very little/none, released between midday and midnight ; ref to, regular/diurnal, pattern ; most pollen released at 0700 each day ; ref to figures for maximum release ; e.g. 500 to 700 pollen grains per hour most pollen released when wind speed low/very little pollen released when wind speed higher ; maximum pollen released when relative humidity high/ORR ; steep decrease in pollen release as relative humidity falls ; ref to figures in support ; ref to data for, wind speed/humidity ; <i>max 6</i>	<b>6</b>
2(b)	(confidence limited by): only data from three days ; no information on how many, sites/plants ; not repeated ; not carried out by other people/no data on reproducibility ; no data with, constant wind speed/wind speed higher at night than during the day ; no data with, constant relative humidity/humidity higher early part of day/ AW ; <i>idea that</i> correlation does not prove causation/AW ; not an experiment as no factors have been controlled ; data not analysed statistically therefore impossible to assign level of significance/confidence in the conclusions ; <i>max 4</i>	<b>4</b>

Question	Answer			Marks																					
3(a)(i)	<table border="1" data-bbox="308 237 1145 600"> <thead> <tr> <th data-bbox="308 237 459 286">protein</th> <th data-bbox="459 237 842 286">relative molecular mass</th> <th data-bbox="842 237 1145 286">relative mobility</th> </tr> </thead> <tbody> <tr> <td data-bbox="308 286 459 338"><b>A</b></td> <td data-bbox="459 286 842 338">29 000</td> <td data-bbox="842 286 1145 338">0.86</td> </tr> <tr> <td data-bbox="308 338 459 389"><b>B</b></td> <td data-bbox="459 338 842 389">68 000</td> <td data-bbox="842 338 1145 389">0.38</td> </tr> <tr> <td data-bbox="308 389 459 441"><b>C</b></td> <td data-bbox="459 389 842 441">unknown</td> <td data-bbox="842 389 1145 441">0.72</td> </tr> <tr> <td data-bbox="308 441 459 492"><b>D</b></td> <td data-bbox="459 441 842 492">17 200</td> <td data-bbox="842 441 1145 492">1.00</td> </tr> <tr> <td data-bbox="308 492 459 544"><b>E</b></td> <td data-bbox="459 492 842 544">43 000</td> <td data-bbox="842 492 1145 544">0.62</td> </tr> <tr> <td data-bbox="308 544 459 595"><b>F</b></td> <td data-bbox="459 544 842 595">77 000</td> <td data-bbox="842 544 1145 595">0.36 ; ;</td> </tr> </tbody> </table> <p data-bbox="308 633 528 734">5 correct = 2 3 or 4 correct = 1 0, 1 or 2 = 0</p>			protein	relative molecular mass	relative mobility	<b>A</b>	29 000	0.86	<b>B</b>	68 000	0.38	<b>C</b>	unknown	0.72	<b>D</b>	17 200	1.00	<b>E</b>	43 000	0.62	<b>F</b>	77 000	0.36 ; ;	<b>2</b>
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3(a)(ii)	<p data-bbox="308 752 1326 887">x-axis for relative mobility, y-axis for relative molecular mass, sensible scales ; axes labelled appropriately ; points plotted correctly ; allow ecf from <b>(a)(i)</b> straight line – not extending beyond first and last point ;</p>			<b>4</b>																					
3(b)	<p data-bbox="308 909 1002 967">co-ordinates on graph explained or shown on graph ; answer = approx 34 000 ;</p>			<b>2</b>																					

**Section B**

Question	Answer	Marks
4	<p><b>defining the problem</b></p> <p>Hypothesis or prediction ; e.g. rate of uptake of glucose is faster than rate of uptake of maltose/<math>K_m</math> for uptake of glucose is lower/transport protein has a higher affinity</p> <p>Theory to support hypothesis or prediction ; e.g. glucose is a smaller molecule/does not require to be hydrolysed by enzyme/ref to production of maltase inside yeast cell</p> <p>Outline of strategy and justification/evaluation ; e.g. method of following the uptake of glucose and maltose separately taking samples at intervals and calculating uptake</p> <p><i>this could be awarded at the end of the plan</i></p> <p>method of determining (the concentration) of glucose at intervals ; method of determining (the concentration) of maltose at intervals ;</p> <p><i>e.g. (semi) quantitative Benedict's solution</i></p> <p>At least two control variables ; e.g. <i>temperature, concentration of yeast, pH, volumes used, pre-treatment of glucose</i></p> <p><i>Risk assessment ; ref to hazard <u>and</u> precaution</i></p> <p><i>some points may be taken from a diagram or a flow or sequence diagram</i></p> <p>max 6 marks for defining the problem</p>	6

Question	Answer	Marks
4	<p><b>methods</b></p> <p>use range of concentrations of glucose and maltose ; <i>and/or</i> use range of concentrations of yeast suspension ; <i>to find suitable concentrations to make comparison</i> dilution table(s) included ;</p> <p>yeast mixed with glucose and maltose solutions ; equilibration in water bath ; staggered start ;</p> <p>samples taken at stated intervals ; filtered to remove yeast ; suggested method of finding concentration of sugars described ; calculate quantity of sugars absorbed knowing initial concentration ; details of calculation ; uncertainty/precision, of results ;</p> <p>plot results and take gradient to give initial rate ; calculate mass of sugar absorbed per unit time ;</p> <p>repeats / replicates ; calculate, standard deviation / standard error / 95% CI ;</p> <p>plot overall graph as a line graph ; state that answer is where rate of uptake becomes constant ; find <math>K_m</math> ; find <math>\frac{1}{2} K_m</math> ; discussion of affinity of transport proteins ;</p> <p>use, suitable named statistical test ; e.g. <i>t</i>-test / <i>z</i>-test / ANOVA</p> <p>AVP ; AVP ;</p> <p>max 19 marks for methods</p>	19
	Available marks	<b>25</b>