



Cambridge International Examinations
Cambridge Pre-U Certificate

BIOLOGY (PRINCIPAL)

9790/02

Paper 2 Data Analysis and Planning

For Examination from 2016

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 60

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

This document consists of **6** printed pages.

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
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

- 1 (a) (i) 1016 ; [1]
- (ii) *max 3 for comments on accuracy:*
 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 ; [max 3]
- max 3 for comments on limitations:*
 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 ; **A** '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 ;
 effect of any named limitation giving, underestimate / overestimate, of population size ;
 AVP ; [max 3]
- (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 ; [max 3]
- (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 ; [max 3]
- (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 ; [max 4]

[Total: 17]

- 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 / ORA ;
 steep decrease in pollen release as relative humidity falls ;
 ref to figures in support ;
 ref to data for, wind speed / humidity ; [max 6]

- (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 ;
idea that 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 ; [max 4]

[Total: 10]

- 3 (a) (i)

protein	relative molecular mass	relative mobility
A	29 000	0.86
B	68 000	0.38
C	unknown	0.72
D	17 200	1.00
E	43 000	0.62
F	77 000	0.36 ; ;

5 correct = 2

3 or 4 correct = 1

0, 1 or 2 = 0

[2]

- (ii) x-axis for relative mobility, y-axis for relative molecular mass, sensible scales ;
 axes labelled appropriately ;
 points plotted correctly ; allow ecf from (a)(i)
 straight line – not extending beyond first and last point ; [4]

- (b) co-ordinates on graph explained or shown on graph ;
 answer = approx 34 000 ;

[2]

[Total: 8]

Section B – Planning

4

Sections	Expected answer	Mark
defining the problem	<p>Hypothesis or prediction ; e.g. rate of uptake of glucose is faster than rate of uptake of maltose / K_m 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. temperature, concentration of yeast, pH, volumes used, pre-treatment of glucose</p> <p><i>Risk assessment ;</i> ref to hazard <u>and</u> precaution</p> <p><i>some points may be taken from a diagram or a flow or sequence diagram</i></p>	[max 6]

methods	<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 K_m ; find $\frac{1}{2} K_m$; 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>	[max 19]
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[Total: 25]