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

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

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[Turn over

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	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 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 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 *this could be awarded at the end of the plan* method of determining (the concentration) of glucose at intervals **;** method of determining (the concentration) of maltose at intervals **;** *e.g. (semi) quantitative Benedict's solution* At least two control variables **;** *e.g. temperature, concentration of yeast, pH, volumes used, pre-treatment of glucose* *Risk assessment* **;** ref to hazard <u>and</u> precaution *some points may be taken from a diagram or a flow or sequence diagram*	[max 6]

methods	use range of concentrations of glucose and maltose ; *and / or* use range of concentrations of yeast suspension ; *to find suitable concentrations to make comparison* dilution table(s) included ; yeast mixed with glucose and maltose solutions ; equilibration in water bath ; staggered start ; 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 ; plot results and take gradient to give initial rate ; calculate mass of sugar absorbed per unit time ; repeats / replicates ; calculate, standard deviation / standard error / 95% CI ; 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 ; use, suitable named statistical test ; e.g. *t*-test / *z*-test / ANOVA AVP ; AVP ;	
		[max 19]

[Total: 25]