Cambridge International Examinations
Cambridge Pre-U Certificate

BIOLOGY **9790/02**

Paper 2 Data Analysis and Planning **May/June 2016**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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

Notes:

The following abbreviations may be used in mark schemes:

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

Section A – Data Analysis

1 (a) (i) 1.90 ; **A** 1.9 **[1]**

(ii) allows, comparison between animals of different masses / (valid) comparison ; **[1]**

(b) 1 rat has double circulatory system / described ;
2 allows higher blood pressure in, systemic circulation / described ;
A has different pressures in two systems
3 ref. to thickness of left ventricle (wall) ;
4 AVP ; e.g. insect has an open circulatory system (so cannot have high blood pressure) / ORA for rat / fish / toad
fish / toad, has single circulatory system (so limits maximum blood pressure) **[max 3]**

(c) 1 comparative description of data ; e.g. highest in rat

explanation of relative oxygen levels with reference to:
2 oxygen not transported in blood of insects ;
3 tracheal system in insects ;
4 deoxygenated blood at **X** in fish / blood comes straight from body ;
5 single circulatory system in fish ;
6 mixing of deoxygenated blood in amphibians ;
7 common ventricle in amphibians ;
8 no mixing of deoxygenated and oxygenated blood in mammals / blood comes straight from lungs ;
9 double circulatory system in mammals ;
10 higher metabolic rate in mammals ; **[max 3]**

(d) (i) *bald notothen lives at lower temperatures:*
1 less active ;
2 lower, rate of respiration / metabolic rate ;
3 lower requirement for, oxygen / metabolites / removal of carbon dioxide ;
4 *idea that* cardiac output per unit mass of both fish is the same so the difference in heart rate is due to difference in stroke volume per unit mass ;
5 AVP ; e.g. ref to difference in, body mass / gill surface area / solubility of oxygen **[max 3]**

(ii) *award two marks for the correct answer*
70(%) ; ;
if answer is incorrect or not given then award one mark for the working:
21 / 30 × 100 ; **[2]**

(iii) 1 increase in heart rate / increase in stoke volume ;
2 increase blood flow to / vasodilation in, muscles ;
3 increase in aerobic respiration / ref. to avoiding anaerobic respiration ;
4 greater requirement for, oxygen / glucose / removal of carbon dioxide ;
5 increase in muscle contraction ;
6 AVP ; e.g. disproportionate increase in stroke volume **[max 3]**

[Total: 16]

2 **(a)** 1 positive correlation between island area and species number / AW ;
2 comparative data quotes ; (minimum of two)
3 larger islands offer greater range of, ecosystems / habitats / niches ;
4 greater availability of resources ;
5 ref. to adaptation / speciation ;
6 AVP ; e.g. less competition / possibility of isolation and speciation ; **[max 4]**

(b) **(i)** choice of appropriate scales using more than 50% of the axes ;
points plotted correctly ; **[2]**

(ii) *mark to max 1 if 50 km^2 used on the second graph*

1.7 ; **A** 1.6 to 1.8
evidence of using Fig. 2.1 to estimate the number of species ;
evidence of using the second graph to estimate the extinction rate ; **[3]**

(iii) 1 negative correlation between number of species and rate of extinction / AW ;
2 link made between island size from Fig. 2.1 and extinction rate ;
3 vulnerable to catastrophe(s) ;
4 small, populations / gene pool ;
5 inbreeding depression ;
6 AVP ; **[max 3]**

(c) 1 ref to isolation of island / geographic isolation ;
2 reproductive isolation / little or no gene flow ;
3 allopatric speciation ;
4 mutation / variation ;
5 selective pressures are different from mainland ;
6 founder effect / described ;
7 genetic drift / describe ;
8 adaptive radiation ;
9 AVP ; **[max 3]**

(d) 1 incorrect identification of species ;
2 difficulty defining a species ;
3 difficult to find all the species ;
4 difficulty of using historical data ;
5 lack of fossil data ;
6 uncertainty of line of best fit due to insufficient data ;
7 uncertainty of line of best fit due to scatter of data ;
8 AVP ; e.g. extinction rates fluctuate **[max 4]**

[Total: 19]

Section B – Planning

3 *defining the problem:*

1 hypothesis of prediction or null hypothesis ;
e.g. release of parasitic wasp will reduce, numbers / diversity, of native weevil population

2 theory to support hypothesis or prediction ;
e.g. parasitic wasps are not specific to pest weevils
introduced wasp is able to migrate into adjacent fields

3 independent variable ;
either
release wasps or not
or
release different numbers of wasps

4 dependent variable ;
either
weevil population sizes
or
number of different weevil species

5 at least **two** control variables ;
e.g. repeated during similar weather conditions
collections / release at, same, time of day / season

6 risk assessment ;
this must refer to both a hazard and a suitable precaution
accept hazards to human health and environment

methods:
some points may be taken from a diagram such as a flow or sequence diagram

1 identify area to be studied ;
2 marking of study site ;
3 method for random sampling described ;
4 identification of weevil species ;
5 describe method of capture ;
e.g. sweep net / pitfall trap / hand search / quadrats
6 multiple traps ;
7 time period for collection stated ;
8 details of marking method described ;
9 numbers of captured individuals counted and recorded ;
10 release of marked individuals ;
11 suitable period of time before collection stated ;
12 recapture of individuals ;
13 number of recaptured individuals counted and recorded ;
14 number of marked recaptured individuals counted and recorded ;
15 measurement / recording, of at least one abiotic factor ;
16 recording of at least one biotic factor ;
17 repeat after wasp release ;
18 repeat(s) entire investigation ;
19 use of a control ; e.g. area with no release of wasps

analysis:

1 calculation of total population size using Lincoln index ;
2 use of equation, N = mn / r ;
N = total population size
m = number captured and marked in first sample
n = number in second sample
r = number of marked individuals recaptured in second sample
3 descriptions of assumptions made ; ;
+ e.g. mobility of weevils / closed sample area / random recapture
4 zero birth / death rate, between collections
5 calculation of, standard deviation / standard error / 95% confidence, intervals / limits ;
6 use of a suitable statistical test ;
e.g. Spearman's Rank (wasp numbers vs weevil numbers)
t-test (control vs test site)

evaluation:

1 evaluation of assumptions made ; ;
+ e.g. mobility of weevils / closed sample area / random recapture
2 zero, birth / death rate, between collections
3 identification of at least one uncontrollable factor ;
e.g. weather

AVP ; ; e.g. interpretation of statistical test

[max 25]

[Total: 25]