UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

9693 MARINE SCIENCE

9693/04 Paper 4 (A2 Data Handling/Free Response), maximum raw mark 50

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.

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1 **(a)** both axes correct way around (temperature on the x axis) + labels + units;
all points plotted correctly;
line / curve of best fit drawn; [3]

(b) correct value from candidates graph; [1]

(c) to ensure that the recent diet had no effect on oxygen consumption; [1]

(d) any 2 from:
number of fish / species of fish / mass of fish / size of pool; [1]

(e) less plankton available for food;
less oxygen available;
fish have a higher rate of respiration;
higher demand for oxygen / glucose (or eq);
reduced population of pilchards; [max 4]

[Total: 10]

2 **(a)** (steady) increase at first that then levels off (both needed);
increase until 325–350 / rate of increase slows down from 325 days / levels off at 300 g; [2]

(b) 250–350;
no more growth beyond this / growth rate is very slow (or eq);
costs of feed outweighs the benefit; [3]

(c) **(i)** both sexes reach a larger mass than in high protein;
both sexes grow faster;
both sexes grow for longer / level off later;
credit manipulated numerical answer;
male fish have a larger mass than female fish (on equivalent diets);
(allow converse for all points) [max 3]

(ii) low protein diet : idea of when food is more expensive than price of fish yield;
High protein diet: faster growth to reach optimal mass; if market price for large fish is high;
high protein diet: when there is demand for rapid production (growth rate) and food is cheaper; [2]

[Total: 10]

3 **(a)** as size increases, SA:Vol ratio decreases;
spherical organisms have higher sa: vol;
flatter shape gives higher ratio;
ref to projections/ villi / filaments increasing SA;
credit a specific named example; [max 3]

(b) Coral
large SA:Vol ratio;
diffusion use (ONCE);
short diffusion pathway;
oxygen absorbed / carbon dioxide released (ONCE);
no ventilation movement;
low activity equates to low oxygen demand;

Grouper
small SA: Vol ratio;
gills increasing surface area;
gill ventilation mechanism (or eq);
high oxygen demand due to high activity;
blood transport system for gas transport; [max 6]

(c) buccal pump requires pressure changes / operculum movement (or eq);
idea that water is "pushed" over gills;
buccal pumping is used to keep water moving over gills when not swimming;
ref to energetic costs of either method;
ram ventilation requires open mouth and swimming pushes water through;
faster swimming requires faster muscle contraction;
higher oxygen demand (for faster swimming);
higher respiration rate (when swimming faster);
faster movement of water over gills with ram ventilation; [max 6]

[Total: 15]

4 **(a)** correct example (Hg / DDT / paint / antifouling paint);
toxin enters at base of food chain (producers / primary consumers);
not broken down;
idea of many organisms consumed at the next trophic level;
concentration (of toxin) increases with each trophic level;
top consumers most affected / die;
named specific example of organisms; [max 5]

(b) Death of organisms / eggs due to inflow;
Release of brine into sea;
Ref to osmotic damage (or eq);
Lowered oxygen concentration in water / release of damaging cleaning chemicals / increased turbidity of water;
High start up costs / maintenance costs;
High energy / fossil fuel / power (or eq) demand;
Increased employment;
Idea of profitability in correct context (e.g. increased agricultural profit due to irrigation);
Loss of tourism; [max 5]

(c) pros:
habitat / substrate for many species;
increased biodiversity;
conservation of threatened / endangered species;
conserve coastlines / act as a breakwater (or eq);

cons:
artificial reefs can cause damage to natural habitats / idea of physical damage to sea bed;
displace naturally occurring species and habitats / ecosystems;
concentrate fish unnaturally;
idea of overcompetition for resources;
introduce toxins and other pollutants into the ocean; [max 5]

[Total: 15]