UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9693 MARINE SCIENCE

9693/02 Paper 2 (AS Data-Handling and 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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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International Examinations

1 **(a)** ref to the presence of zooxanthellae/eq in corals ;
need light for photosynthesis/eq; [2]

(b) reference to use of a light meter/light probe/eq;
measure light intensity in sea next to wreck/where coral is growing;
take measurements at different time of the day;
take measurements on different days (during the summer);
measure light intensity in laboratory;
ref to measuring light duration; [4]

(c) factors to include:
availability of food/nutrients;
increase in food will increase growth;

depth in water;
growth decreases with increased depth;

presence of predators/competitors;
predators will decrease growth;

ACCEPT appropriate converse effects on growth

Note: other factors could include:
turbidity of water; pH of sea water; dissolved oxygen; sedimentation; pollution; salinity; disease; carbon dioxide; wave action; [6]

[Total: 12]

2 **(a)** rate of accumulation of biomass/energy;
per unit area/per unit volume; [2]

(b) **(i)** 2.2 (%); [1]

(ii) not all light is absorbed by phytoplankton/light passes through;
ref to incorrect wavelengths/colours;
some reflected;
ref to losses in plant respiration;
credit NPP = GPP – R;
ref to the inefficiency of photosynthesis; [3]

(iii) ref to energy losses (between trophic levels);
only 9% transferred from phytoplankton to zooplankton/between trophic levels/credit reason for loss (e.g. parts uneaten/undigested/excretion/egestion)/insufficient energy available to transfer (to support more than 5 trophic levels);
Note: "loss of heat energy" gains both mark points [2]

[Total: 8]

3 (a) **magnesium** for:
(synthesis of) chlorophyll;

calcium for:
bones;
corals;
shells;
formation of carbonates/corallite;

phosphorus for:
DNA;
ATP;
phospholipids;
bone;
formation of calcium phosphate/apatite; [6]

(b) credit references to:
dead organisms/organisms die/detritus;
faeces;
sinking to sea floor;
ref to (slow) decomposition on sea bed;
(because) cold/lack of oxygen;
incorporation into reefs;
harvesting/eq; [4]

(c) credit references to:
upwelling;
due to currents/explanation of upwelling/eq;
further details (e.g. of inorganic nutrients released by decomposition);
leaching/run off (from land);
e.g. phosphates or nitrates;
dissolving of atmospheric gases;
carbon dioxide; [5]

[Total: 15]

4 (a) (i) ref to photosynthesis/autotrophic nutrition/conversion of light energy to chemical energy/ eq;
example, such as algae/eq; [2]

(ii) ref to change in community structure over time;
credit suitable example;
Note: the syllabus refers to *Tevnia* and *Riftia* [2]

(b) credit references to:
exposure (time), affects ability to withstand drying out;
availability of air/oxygen, ref to gas exchange by gills or lungs;
temperature, affects drying out;
salinity, ref to osmoregulation/eq;
wave action/erosion/eq, ability to hold onto rocks/eq;
substrate, provides surface for attachment/eq;
Note: for each mark point, expect both the factor and its effect on organisms [5]

(c) general points:
biodiversity explained as number of different species/types;
extreme environments have limited resources/few niches;
organisms need special adaptations;
few organisms adapted;

unstable:
sand needs ways of avoiding slippage;
burrowing (to avoid being swept away);
credit example (e.g. crabs, worms, molluscs);

extreme;
thermal vents have high temperatures/high pressure/low pH/eq;
ref to specialised enzymes;
credit example (e.g. chemosynthetic bacteria, tube worms); [6]

[Total: 15]