MARK SCHEME for the October/November 2013 series

9693 MARINE SCIENCE

9693/03   Paper 3 (Structured), maximum raw mark 75

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 October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

1 (a) (i) *Allow single value depths within the range, approximate values ± 1 m*
No actual depths or incorrect depths given, allow 1 mark for general pattern.

4 of:
as the depth increases the species types changes ;
shallow water / 3 m–4 m is occupied by Shoal grass ;
4 m–12 m depth occupied by Turtle grass ;
12 m–25 m depth occupied by Manatee grass ;
very deep water / more than 40m occupied by Star grass and Paddle grass ;   [4]

(ii) 2 of:
light (penetration) ; **A** turbidity
salinity ;
air exposure / desiccation ;
pH ;
temperature ;
nutrient / carbon dioxide supply ;   [2]

(b) (i) 1 idea that roots along a horizontal stem give strong anchorage / attachment ;
2 idea that thin leaves offer less resistance to wave action ;
I ref. to photosynthesis ;   [2]

(ii) idea that roots binds together sediment / sea bed (so it is not washed away) ;   [1]

(iii) *Answers need to be in context of coral requirements for successful growth.*

3 of:
corals can only grow where there is a lot of light ;
binding of sediment makes the water clear / reduces turbidity ;
lets enough light enter for zooxanthellae of corals to grow ;
stabilisation of sea bed allows coral to attach ;
high nutrient requirement of sea grass reduces nutrient content of water ;   [3]

[Total: 12]

2 (a) (i) the ability to keep the concentration of its body water / salt concentration constant (independent of the external salt concentration) ;   [1]

(ii) 4 of:
water is lost constantly through the skin (by osmosis) ; **A** body surface
as seawater has a lower water potential than the fish (body fluids) ;
ions (salt) constantly enters through the skin (by diffusion) ;
sea water is swallowed to replace water lost ;
excess ions are removed from the gills ;
by active transport / using energy from respiration ;
kidney also (actively) secretes salts ;
urine is very concentrated ;   [4]

(b) (i) The ability to osmoregulate in both a marine and freshwater environment ;
A able to tolerate a (wide) range of salinities [1]

(ii) salmon / trout / eel / tilapia ; [1]

(iii) *more than one arrow dawn for each, must all be in same direction.*
arrow out from gills labelled water ; A solid line arrow without label
arrow out from gill labelled ions ; A dotted line arrow without label [2]

(iv) 2 of:
body fluids of fish have lower water potential / are more concentrated than
fresh water ; ora
water moves in by osmosis ;
ions / salts move out by diffusion ; [2]

[Total: 11]

3 (a) (i) 2 = eggs ;
3 = larvae / embryos / hatchling ; R newly hatched fish
4 = juvenile / young fish ; [3]

(ii) 1= offshore / reef edge / open water ; R coral reef A open sea /ocean
2 = (open) ocean (surface) / planktonic ;
3 = (open) ocean (surface) / planktonic ; A free floating
4 = inshore / sea grass beds / mangrove ; [4]

(b) *Max 2 marks if only similarities or differences given.*
3 of:

Similarities:
spawn in groups (offshore) ;
external fertilisation ;
eggs planktonic / feed on yolk for first few days of life ;
larvae planktonic ;

Differences:
grouper change sex / female in early life become male later, tuna do not change sex ;
grouper young have juvenile / specific habitat, tuna form shoals in sea ;
A idea that grouper changes habitat at different stages in life cycle, tuna stays in same
habitat ; [3]

[Total: 10]

4 **(a)** **(i)** increases ;   [1]

   (ii) $\dfrac{750-610}{50}$ or $\dfrac{750-612}{50}$;

   = 2.8 or 2.76 mg m^{-3} y^{-1} ; max 1 if no units / no working shown   [2]

   (iii) 3 of:
   idea of (increase in) use of road vehicles / petrol / fossil fuels ;
   idea of increasing industrialisation (in the world / named countries) ;
   idea of increasing population needing more land / deforestation (cleared for agriculture) ;
   idea of carbon footprint of food / people transport increasing ;   [3]

   (iv) 1 of:
   ice borings show past changes / increases in carbon dioxide content in air ;
   fossil records show plant / animals adapted to hot climates in present day cold climates
   ora ;
   A reference to natural phenomena e.g. volcano emissions
   I reference to CFC and methane / ozone layer   [1]

(b) *Answers should be in terms of environmental change. Ignore references to ecological consequences.*

   5 of:
   air temperature will increase / global warming ;
   sea water temperature will increase ;
   (causes) decreased oxygen / reduced solubility of gases ;
   melting of ice caps ;
   increases in sea level / flooding of land ;
   increased carbon dioxide in water ;
   lower pH of water ;
   (causes) corals killed / coral bleaching ; **A** in context of water temperature
   ref. to effects on crustacean shells / coral skeletons / phytoplankton ;   [5]

   [Total: 12]

5 (a) (i) *Incorrect answer from correct working max 1*

$263\,000 \times 4\dfrac{(\times 1000)}{(1000)}$; **A** any other valid working

= 1 052 000 / 1.052 × 10^6 (tonnes) ;   [2]

(ii) 3 of:
some of the species / named example are already overfished for human food ;
the rate of increase of aquaculture has increased demand on fish meal / fish oil ;
demand may result in **more** fishing beyond MSY / overfishing ;
ref. reduces biodiversity / disruption to marine food chains / species loss ;   [3]

(iii) 1 of:
ref. to reducing the rearing of carnivorous fish ;
ref. to increasing the rearing of herbivorous fish / filter feeders ;
ref. to more research into alternative food sources for carnivorous fish ;
A genetically modified fish that have better food use efficiency
R aquaculture of wild fish   [1]

(b) (i) *Answers for* **(i)** *and* **(ii)** *should link to knowledge of conditions that favour the growth of kelp. Answers for* **(i)** *must relate to both sites, separate descriptions should not be credited.*

3 of:
ref. to suitable depth of water related to size of plants ;
ref. to good water clarity related to light penetration for photosynthesis ;
ref. to suitable water temperature related to kelp growth in cool /5°–20°C water ;
ref. to ocean current mixing water / bringing nutrient ;   [3]

(ii) 3 of:
site 1 has better light penetration ;
more light may give better / more growth of kelp ;
A better / more photosynthesis
site 1 is in a rocky area ;
kelp needs solid surface to attach firmly ;
water is warmer / temperature 2°C higher ;
higher temperature may give better / faster / more growth of kelp ;
ocean current is closer / reaches area 1 first ;
so better nutrient supply ;   [3]

[Total: 12]

6 (a) (i) 53 / 54 (%) ;   [1]

   (ii) $\dfrac{35}{56}$;

   = 0.6(3) % per year ; *units must be given*   [2]

   (iii) 3 of:
   increase in world population increases demand for fish ;
   popularity / fashion in eating habits for certain species ;
   higher prices for these species ;
   overfishing / over exploitation of these species ;
   A descriptions e.g. use of modern equipment that catches all fish **AW**
   habitat destruction ; allow example **A** natural disasters e.g. tsunami
   pollution (of water) ; allow example   [3]

(b) 2 of :
   loss of genetic diversity by crossing between wild and cultivated stock ;
   transmission of disease / parasites from farmed fish ;
   loss of biodiversity as more coastal regions used for aquaculture ;
   R competition for food / prey predator relationships / disruption to food chains   [2]

(c) (i) mangroves provide shelter / nursery grounds for fish ;
   A escape / protection from predators
   food sources / plants / crustaceans in mangroves supply food for fish ;
   A nutrients   [2]

   (ii) 2 of:
   protection of coast line from storms / tsunami ;
   (roots) stabilise shore line / bind silt / bind sand ;
   (roots) reduce wave action / slow down water movement ;
   prevent erosion of shoreline ;
   A idea of increasing biodiversity / alternative resource for local people ;
   R any answers related to fish stocks   [2]

[Total: 12]

7 (a) *Answers should be related to the perceived benefits of conservation either environmental or economic. 3 of arguments for conservation*:
coral reefs have great biodiversity ;
e.g. 75% of all known species of coral ;
biodiversity should be retained to ensure balance in the ecosystem ;
A to prevent extinction of species / named species
are important fish breeding areas ; **A** nursery areas for fish
(biodiversity) is essential commercially as fish are part of complex food webs ;
location for / protection for endangered species (of turtle) ;
idea of preserving for future generations ;
give protection to coast lines from storms ; **A** named countries in coral triangle
idea of ecotourism to see unspoilt / biodiversity of reefs ;
idea of unsustainable fishing if it is unchecked / illegal ;
marine organisms may be sources of pharmaceuticals ;   [3]

(b) *Answers should be related to the perceived benefits making no changes either environmental or economic. 3 of arguments against conservation*:
fishing is a main source of income for many people ;
illegal methods catch more fish with less effort (making more money) ;
increase in population means there is a greater demand for food ;
live fish trade / LRFFT brings more money into the country ;
improved economy helps governments to improve standard of living ;
protection could change traditional way of life for many people ;
A ref. to other threats to coral reefs that would not be affected by conservation
e.g. global warming / pollution   [3]

[Total: 6]