MARINE SCIENCE

Paper 9693/01
AS Structured Questions

General comments

It was pleasing to note the increased entry for this examination this year.

In general, questions or parts of questions requiring analysis and interpretation of data and graph drawing (part of **Questions 2**, **3**, **4 and 5**) generated a better quality of response than those questions requiring knowledge and understanding of the subject matter of the syllabus (**Questions 1**, **4 (a)**, **5 and 6 (a) and (b)**.

This lack of the basic knowledge of some parts the syllabus content is rather disappointing and not what was expected. Details of this are given in the comments on individual questions.

Comments on specific questions

Question 1

(a) (i) Only a minority of candidates were able to give an accurate definition of the term 'species'. Many answers were confused or vague and in numerous instances the definitions given applied to a major group such as mammals or fish. Answers such as, 'a group of whales is a species', really missed the point.

The essence of the definition i.e. the ability of the organism to interbreed was rarely present in candidate's responses.

(ii) Most candidates were able to provide a sufficiently accurate definition of the term 'population'.

(iii) Most candidates were aware that a 'community' encompassed organisms in a specific habitat although some definitions given were often of a 'population' rather than a 'community'.

(iv) It was pleasing to note the large number of candidates who were aware that an 'ecosystem' is made up of biotic and abiotic elements.

(b) (i) Few candidates gained full marks on this section of the question.

Marks were most often gained for a reference to the sun as a source of energy in Photosynthesis (this point being particularly well known) and for a valid reference to chemosynthetic bacteria.

Correct attempts to describe and explain how the energy source for chemosynthesis is derived from chemical reactions were unusual. Answers were usually very brief and answers such as 'energy comes from sulfur' were common.

(ii) Most candidates gained credit for at least one or two of the three marks available for this part of the question. This was usually for a reference to very high temperatures or high pressures or lack of light.

Question 2

(a) Almost all candidates were aware that the process of evaporation increases the salinity of seawater.

(b) Most candidates were able to state at least two factors affecting the chemical composition of seawater. The most common responses were 'precipitation', 'erosion' and 'volcanic activity'. Other valid factors which were rarely mentioned were 'upwelling' atmospheric dissolution'. Biological activities such as respiration and photosynthesis were rare in candidate's answers.

(c) (i) One of the most common errors in this part of the question was to describe the changes shown in Fig. 2.1 in such a brief or vague answer and then to attempt an explanation of the changes. Many candidates seemed to be unaware of the difference between describe and explain. Candidates need to be aware of the type of response required by these two command words. Another very common error prevalent in candidates' answers were references to a time factor for the changes. Responses such as 'a very rapid fall' or a slow fall' were relatively common despite the chart having no reference to time of the changes. Of course, the question required candidates to describe changes in temperature with depth as shown in the chart. Generally, most candidates were able to score one or two marks for describing one or more of the changes shown in the chart.

(ii) The shaded area was often named as the halocline (possibly taking the answer from **part (d) (ii)** rather than the thermocline.

(d) (i) Plotting of the graph was generally very well done despite the unusual nature of the graph. A smooth curve or a straight line drawn point to point were both acceptable. However, the drawing of the line was extremely poor. Many candidates attempted a line of best fit which was not appropriate for the type of data shown. Points were very often missed and lines were very thickly or untidily drawn often in pen.

Candidates should be made aware that graph lines should be drawn cleanly with a ruler in pencil.

(ii) The majority of candidates appreciated that the salinity decreased within the halocline. Generally, only the more able candidates gained the second mark for quoting figures from the graph.

Question 3

(a) (i) Most candidates gained one mark for the appreciation that predators eat other animals. However, few realised that this could refer to other feeding relationships such as scavengers. It was rarely quoted that predators actively hunt or kill their prey.

(ii) Most candidates had great difficulty in expressing themselves when trying to explain the meaning of a trophic level. Typical of the quality of responses were answers such as 'a trophic level is where animals and plants are in a food web.

(b) (i) This was well answered.

(ii) The most common correct responses were 'disease' and 'fishing'.

(c) Most candidates appreciated the fact that carnivores feed on more than one type of organism meant they were not dependant on a single food source and could feed on other organisms if their primary food source disappeared.

(d) (i) This was well answered by the majority of candidates who often scored at least two of the three available marks. References to figures from the graph were very often correctly quoted in contrast to the answer in **Question 2 (d) (ii)**.

(ii) Most candidates gained credit for one mark in this part of the question. This was most often for a reference to the rise and fall of the two populations closely following each other. Occasionally, candidates referred to the cod population always being less than that of the Pollock which is indicative of a predator – prey relationship.

(iii) A reference to the arrowhead having other sources of food was the most common correct response.

Question 4

(a) (i) Most candidates gained one or two of the three available marks.

Candidates generally appreciated that sediment would accumulate on the coral and this would lead to a reduction in photosynthesis. What was often omitted in candidates' responses was a reference to the sediment blocking light to the zooxanthellae within the coral tissues and the link between this and consequent reduction in photosynthesis.

(ii) This part of the question was usually poorly answered and few candidates appreciated that some of the additional carbon dioxide would dissolve in seawater creating more acid conditions with the consequent damage to the coral skeleton. Answers were usually quite vague and lacking in precision. Typical of these were answers such as 'the chemical composition of the ocean changes' or 'the carbon dioxide would kill the algae'.

(b) Both **parts (i)** and **(ii)** were usually answered correctly.

(c) (i) This was well answered.

(ii) This was also well answered and a wide number of valid responses were seen. These ranged from concrete and steel are 'strong', 'stable', 'non-toxic', 'long lasting' and various other valid features of the materials.

(d) The majority of candidates were able to give at least one or two reasons for the use of artificial reefs. Responses such as 'reduction of erosion' 'restoration of reef ecosystems' and 'as diving sites' or 'for the creation of a tourism asset' were all considered to be valid responses.

Question 5

(a) There were very few candidates who could define the term 'littoral zone'. The typical type of answer given by candidates was 'the depth to which light penetrates in the sea', 'the part of the coast that supports life' and others such as 'the area of highest productivity'

Few were aware that the littoral zone is the area between high water mark and low water mark permanently submerged at high tide and exposed at low tide.

(b) The most common type of error in the part of the question was to name a correct process such as erosion or sedimentation but then give an incorrect description of the way it affects the shape of a sandy shore or gave general effects such as erosion washing away the sand but failed to make a reference to the effect on the shape of the shore.

(c) Lack of detail was the most frequent feature of the responses to this part of the question.

Often answers simply consisted of a list of environmental factors with little or no direct link to the actual question i.e. how these affect organisms on a rocky shore. This type of answer usually gained half the available marks.

While little detail was required in the answer it had been expected that candidates would expand their answer to make a brief reference to how the factors listed did affect the organisms.

Question 6

(a) This part of the question required a straightforward explanation of the cause of tides using only the subject matter of the syllabus with which candidates should be familiar. However, the quality of answers seen did not, in general, demonstrate that candidates had a detailed knowledge of this part of the syllabus. While there were some excellent responses covering all of the points on the mark scheme many candidates did not gain more than two marks.

The scoring points most often gained were for a correct reference to the gravitational pull of the moon and an appropriate reference to the role of the sun.

An appropriate reference to high and low tides in the correct context was allowed and many candidates gained this mark.

(b) (i) Correct explanations of the term *tidal range* were uncommon. The most common error or misunderstanding was that the term refers to the difference between high and low tide. This answer needed to be qualified by a reference to the difference in height. Other incorrect responses ranged from 'the distance from shore to the sea' to 'the different extents to which a tide will move'.

(ii) Most candidates were able to state at least one factor affecting tidal range. The most frequently seen correct responses were 'air pressure', wind', and 'alignment of Sun and moon'. This latter point was usually phrased in other ways but was considered creditworthy if the meaning was correct.

(c) (i) Very few candidates gave an incorrect answer.

(ii) This was very well answered but a few candidates, by omitting the units, expressed the time difference i.e. 12 hours and 21 minutes as a time i.e. 12.21.

(iii) This was very well answered and answers in the range 0.7 to 1.0 metres were all acceptable.

MARINE SCIENCE

Paper 9693/02

AS Data-Handling and Free Response

General comments

It was pleasing to see some candidates who were able to answer most questions with confidence, demonstrating good understanding of most of the areas tested in these examination questions. However, these were very much in the minority, and most candidates struggled to find relevant material to write in their answers, especially in **Questions 2**, **3** and **4**.

A common problem was poor use of language. Examiners were frequently unable to understand what a candidate was trying to convey. Descriptions often failed to use correct scientific terms. Answers to **Questions 3** and **4** were often very brief and poorly structured.

Comments on specific questions

Section A

Question 1

This was generally the highest-scoring question, with most candidates able to find relevant information in the data to answer **part (b)**.

(a) (i) Some candidates correctly referred to the presence of pigments in the zooxanthellae but many gave almost identical answers to their answer for **(ii)**.

(ii) The majority of candidates correctly stated that zooxanthellae provide nutrients to the coral polpys, but many did not mention photosynthesis, or the types of nutrients provided.

(b) (i) This was generally well answered. Candidates were able to select appropriate information from Fig. 1.1, stating that type **C** zooxanthellae were found in deeper water than **E**, where less light penetrates.

(ii) Most candidates were again able to select appropriate information, commenting on the greater diversity of types of zooxanthellae and greater number of colonies at Cayos Limones. However, a significant minority did not answer the question, simply describing the colonies found at Cayos Limones.

(c) (i) Once again, it was pleasing to see that most candidates could select the appropriate information. The most common correct way of answering the question was to state that there was more sediment at Rio Carti, and that more **E** and no **A** was found there.

(ii) Although there were some excellent answers to this question, it was disappointing to see the majority of candidates unable to describe a simple controlled experiment. Many ignored the emboldened words 'laboratory-based' and suggested collecting data from the two reefs. Some did correctly suggest having several tanks of sea water in a laboratory, some with sediment and some without, into which both **A** and **E** zooxanthellae would be placed. Few stated that coral would be present. Some descriptions did include the control of other variables, such as temperature and amount of sunlight. It was rare to see clear descriptions of what would be measured, or to see mention of repeats or replicates.

Question 2

This proved to be the most difficult question on the Paper, with many candidates scoring zero.

(a) There were some very good answers to this question, which pointed out the close match in the patterns shown in the two Figures, and how this shows the youngest rocks are nearest to the oceanic ridge and the oldest ones furthest away. However, this was relatively rare and most answers contained no relevant points. Some candidates suggested that the changes in the orientation of the Earth's magnetic field were causing sea floor spreading.

(b) Very few candidates showed any understanding of the difficult concept of isostasy. Some did correctly use the fact that the oceanic crust has a higher density than continental crust in answering, and this was credited.

Question 3

(a) This question tested syllabus ***section 7(h)***, and it was disappointing to see that this relatively easy topic is generally very poorly known. Nevertheless, there were some excellent answers, correctly explaining how the land heats up faster than the water in summer, causing a lowering of air pressure over the land which brings in moist air from the ocean.

(b) This question tested syllabus ***section 7(i)***, and it was even less well known than **(a)**. Very few candidates mentioned condensation or latent heat in their answers, and most of those who did simply placed the words amongst others in a meaningless juxtaposition. Very poor use of language and unscientific descriptions were common features of answers. A few drew annotated diagrams, and these did often manage to convey some correct information and earn marks.

(c) This was answered much more successfully, and many candidates who had so far failed to gain any marks in this question were able to make four good points here. However, it was surprising to find numerous candidates from Centres in areas that have direct experience of hurricanes unable to make any clear points.

Question 4

(a) Most answers correctly described runoff and upwelling, but it was rare to see any relevant detail. Very few mentioned the types of nutrients that might enter the sea through runoff from the land, or where these nutrients might have come from. Some did correctly describe how nutrients are released by decay of dead organisms or their waste products in the deep ocean, and how upwelling brings these nutrients to the surface. A few also mentioned nitrogen fixation in the upper regions, converting nitrogen from the air into nitrogen compounds that can be used by autotrophs.

(b) The cycling of calcium is not well known. Some answers did correctly state that calcium compounds are used to make shells and bones. It was very rare to see any mention of runoff from land, or the fact that debris containing calcium ions falls to the sea bed when organisms die. Full marks could have been obtained from a simple flow diagram similar to the one shown in the syllabus for ***section 4(f)***, with labels amended to include information relating to calcium.

(c) This question tested syllabus ***section 4(d)***, and it was very poorly answered. Only a very few candidates explained what productivity is. Some did correctly relate it to photosynthesis. A tiny proportion mentioned that photosynthesis can only occur in the upper layers of the ocean where light penetrates, and that nutrients are frequently in short supply in this region. Very few mentioned specific nutrients, or which ones might be limiting.

MARINE SCIENCE

Paper 9693/03
A2 Structured Questions

General comments

There was a wide range of performance by the candidates. Some showed a good understanding of the course content but in other cases the answers were limited to basic knowledge.

Comments on specific questions

Question 1

Overall this question was well answered by candidates.

(a) (i) Most candidates gained both marks.

(ii) The majority of candidates were able to describe the role of phytoplankton in food chains and webs in relation to photosynthesis. Few mentioned the products of photosynthesis that entered food chains and webs

(b) (i) Although candidates made a correct link to photosynthesis, the majority related their answer to population rather than productivity of the phytoplankton. Better answers referred to pH changes but again did not relate this to productivity.

(ii) Although candidates recognised that there would be a decrease in pH, the answers were related to changes in the population size rather than distribution of species. The majority assumed that there would be a decrease in biodiversity.

Question 2

Overall the question was poorly answered. Candidates did not seem to understand the principles of osmoregulation, in particular the differing consequences on osmoregulation of a marine or freshwater environment. Few referred to the water content of these fluids and even fewer to the salt or ion content.

(a) (i) The answers given by the candidates were too imprecise and referred to 'the body' rather than specifying blood or body fluids, but failed to gain marks as their answers did not address the question being asked.

(ii) Candidates explained how, rather than why, marine organisms osmoregulate. Candidates were expected to show an understanding that the difference in water potential between the internal blood and the external environment results in constant loss of water to the environment.

(b) (i) Few candidates used the information in the table and did not appear to recognise that the water potential gradient in the marine environment is less steep than in freshwater. Answers were very generalised and showed little understanding of the replacement of water loss by drinking sea water has consequential effects on the excretion of ions by the gills.

(ii) Most candidates knew that active transport was involved that required energy from respiration, but few candidates stated what was being actively transported.

(iii) Most candidates gave a correct answer.

Question 3

There were some good answers to this question

(a) The most common error was that candidates' answers tended to drift away from the advantages of internal fertilisation to the advantages of internal development.

(b) Most candidates gained full marks for this question.

Question 4

The answers to this question were varied. Those who understood the graph usually gained high marks. Some, however, misinterpreted the shape of the curve so their answers in part (a) were limited.

(a) (i) The majority of candidates gave a correct answer.

(ii) Most candidates recognised that overfishing was the major cause of the decline, but the explanations were rarely developed beyond the idea of too few fish of breeding age.

(iii) Candidates who understood the graph often gave at least one correct suggestion, but were rarely able to explain why this would affect the fish stock. The most common correct suggestions were quotas and decreased fishing intensity. Candidates who misinterpreted the graph tended to describe how overfishing occurs.

(b) Very few candidates answered this question correctly. Most referred to a temporary fall in catches after which there would be an improvement in catches.

Question 5

Overall this question was well answered. Few candidates, however, seemed be aware of the symbiotic relationship between zooxanthellae and giant clams.

(a) (i) The majority of candidates gave at least two correct responses.

(ii) Most candidates gave a correct answer, most commonly that zooxanthellae is a source of food. This was allowed as an indirect reference to the role these organisms.

(b) (i) Very few candidates answered this question fully. In order to show why the systems are different, some comparison of the operation of the two types of aquaculture was expected. These were not always clearly stated. Most mentioned that the larvae were supplied with food but not how this differed form the seed clams. Similarly, most mentioned that the larvae were supplied with oxygen, but again without a comparison to the seed clams

(ii) Most candidates gave the same correct answer: 'protection from predators'.

Question 6

This question resulted in a variety of answers. Some showed a good understanding of how the cause and location of an oil spillage can result in different ecological effects. Others found this very difficult to explain.

(a) (i) Most candidates did not address the question. The most common incorrect answers were sources other than the oil industry. The most common was car exhaust.

(ii) Most candidates gave an incorrect answer as they included 0.16 million tonnes in the total world input as they did not recognise that oil tankers are part of the transportation figure. One mark was allowed for a correct calculation using this figure.

(b) (i) Candidates found it difficult to explain the differences in the extent of environmental impact following the different oil tanker disasters. Most realised that the fire on the *Sinclair Petrolore* decreased the quantity of oil. Very few, however, seemed to understand that the strong wave action during the hurricane in which the *Braer* sank would disperse the oil so that could be broken down by natural processes. Similarly, although most mentioned that the *Exxon Valdez* spilled oil on the land, very few realised that the close proximity to the shore meant that the oil could not be washed out to sea, so almost all of it would end up on the coastline.

(ii) Most candidates gave a correct answer. The most common was blocking the light from the algae.

Question 7

Although most candidates showed an understanding of conservation, many were unable to relate their knowledge to the specific context of ecotourism.

(a) The majority of candidates gave a partially correct definition. Reference to maintaining biodiversity was not always specified.

(b) There were few correct suggestions. The only common correct response was a reference to local employment. Better answers referred to sustainability.

(c) (i) The majority of candidates gave at least one correct answer. The most popular were road building and building sanitation systems. Very few candidates referred to accommodation.

(ii) Answers tended to be too vague, so although candidates often wrote a lot, they said very little. The only common correct answer was a reference to water pollution and eutrophication.

Question 8

There were some good answers to this question. Poorer answers showed confusion about the likely effects of genetically modified salmon on the wild population.

(a) (i) The majority of candidates gave a correct answer.

(ii) Most candidates did not understand why the two genes are joined together. The most common answer was ‘the genes work together’. Candidates were expected to show an understanding that gene insertion is random so separate genes could end up in different parts of the genome.

(iii) The majority of candidates gave a correct answer.

(b) (i) The only common correct answer was that faster growth would give an increased yield. Only better answers referred to cost savings due to fish being ready for market sooner.

(ii) Most candidates realised that would be more competition, but only better answers referred to specific resources used by the salmon. The most common correct suggestions were related to availability of breeding sites and food sources.

MARINE SCIENCE

Paper 9693/04

A2 Data-Handling and Free Response

General comments

This was the first examination of this paper of the Marine Science Syllabus. The style and difficulty of the questions on the paper was comparable to questions in Biology. The paper proved challenging, exposing the strengths and weaknesses of individual candidates with a good differentiation of the candidates taking the paper. The marks ranged from forty six to twenty six out of fifty. Overall the standard of the candidates was good and there was ample evidence from the full answers given on questions that candidates were familiar with the new material and that there was sufficient time for them to attempt all the questions.

Comments on specific questions

Section A

Question 1

This question was based on data showing the variation in the net primary production with latitude in the surface waters of the oceans of the world for the months January to March and the seasonal cycles in the biomass of phytoplankton and zooplankton for the temperate North Atlantic.

(a) Candidates were asked to describe the changes in net primary production with latitude. Correct responses included very low net primary production north of 60N and south of 60S which then rose south of 60N and north of 60S reaching a plateau from 30N to 30S with a peak at 40N.

(b) This question required candidates to suggest why the peak in net primary production occurs well away from the equator. There were several possible answers including reference to the lack of nutrients on equator despite warmer water and the role of upwelling in southern colder waters resulting in nutrient rich conditions.

(c) A description of the changes in zooplankton biomass was required which proved straightforward for most candidates. It rises until end of May or early June then falls until mid September when it rises again until November.

(d) In this part of the question candidates were expected to use their knowledge and understanding to suggest why the biomass of phytoplankton falls in April and May then increases again in July. A number of explanations were accepted as possible. For the fall in April and May predation by zooplankton and shortage of nutrients were acceptable answers. While in July the reduction in zooplankton numbers leading to less predation by zooplankton and the summer up-welling leading to greater amounts of nutrients would lead to an increase.

Question 2

This question sought to test candidates understanding of principal impacts of aquaculture of shrimps using data from the aquaculture of *Penaeus monodon* - the most widely cultured crustacean species in the world at over 900,000 tonnes coming from aquaculture, chiefly in south-east Asia. The question used data from the comparison of the three methods of shrimp farming - extensive, semi-intensive and intensive aquaculture. From the full answers written by all candidates on all parts of this question this was clearly a topic that candidates were familiar with.

(a) Candidates were asked to outline the main impacts, in terms of habitat destruction, of shrimp aquaculture. Most answers referred correctly to mangroves cut down to build ponds and to pollution from run off from the ponds.

(b) Quantitative data on the three principle methods was used to ask candidates to describe how yield varies with size of pond used. Most candidates had no difficulty in making the point that larger ponds have lower yield going on to quote figures such as that in extensive ponds of two to one hundred hectares yield was fifty to five hundred kg per hectare while in the intensive ponds 0.1 to 1.5 hectares yields were between five thousand and twenty thousand kg per hectare.

(c) Further use was made of the data in the table provided to get candidates to suggest and explain which type of aquaculture was likely to have the biggest impact on natural ecosystems. For the extensive aquaculture larger ponds and larger areas are required leading to greater loss of natural habitats including mangroves compared to the intensive aquaculture in which there is a greater concentration of shrimps in ponds so more potential pollution with greater potential for disease and the potential for damage caused in production of food pellets.

(d) This question required candidates to calculate the optimum daily feeding rate specially formulated pellets for intensive aquaculture from the data supplied for a pond with an area of 3000 m^2. The first calculation was for the total number of shrimp in the pond of twelve thousand from (3,000 × 60) / (5 × 3**).** The calculation for **part (ii)** to find the average body mass of ten gms per shrimp from sixty shrimps weighing six hundred gms then allowed the following calculations to be made

(ii) Total mass of shrimps in the pond = 12,000 × 10 = 120,000 g = 120 kg

(ii) Total feed per day = 120 × 2.0 / 100 = 2.4 kg

The majority of candidates understood what was required and successfully made the correct calculations. One candidate did not attempt **parts (iii)** and **(iv)**

Section B

Question 3

This free-response question was to assess candidates' knowledge and understanding of human impact on marine ecosystems. All candidates apart from one wrote full answers to all three parts and this was clearly an area of the specification with which they were familiar.

(a) In this part candidates were asked to explain the effect of antifouling paint on food chains in the sea. Most answers correctly concentrated on TBT which causes imposex in molluscs in which females develop some male genitalia, including a penis and vas deferens superimposed on the female reproductive system or even sterility in severe cases from concentrations as low as a few parts-per-trillion. This may then lead to catastrophic consequences to marine ecosystems through the potential removal of a vital part of the food chain for example, due to the removal predatory gastropod molluscs. Some candidates correctly referred to the use of heavy metals which may then build up due to biological magnification in food chains.

(b) Candidates were required to describe the impact of global warming on coral reefs. A number of possible effects including warmer seawater leading to coral bleaching in which the coral polyps expel their zooanthellae leading to death of coral and the subsequent weakening of reef structure and potential loss of fish species through habitat loss. It is also possible that a rise in sea level may stimulate growth of corals leading to an expansion of area of coral reefs and that warmer water may lead to an increase in the rate of calcification. The main cause of global warming, carbon dioxide increase, will also lead to acidification of oceans reducing ability of coral polyps to deposit calcium carbonate and possibly to increase risk of disease in coral polyps. A less direct but equally valid effect would be more storms and rainfall leading to an increase in suspended sediment blocking light for zooanthellae and preventing the feeding of coral polyps.

(c) In the final part candidates were asked to discuss the evidence that global warming is caused by human activities. Correct points included the idea that changes have been observed during the period of instrumental temperature records when records are most reliable, particularly on the last 50 years when human activity has grown fastest. Many candidates correctly referred to the impact of the industrial revolution. Further evidence has been provided by observations of the upper atmosphere that have more recently become available and the measurement of increasing atmospheric concentrations of greenhouse gases linked to global changes to land surface, such as deforestation and increasing atmospheric concentrations of aerosols.

Question 4

This free-response question tested candidates' knowledge and understanding of aspects of marine animal physiology with particular reference to surface area and gaseous exchange.

(a) In this part candidates were asked to describe how the surface area to volume ratio of organisms varies with size**.** All candidates correctly referred to the idea that as size increases the surface area to volume ratio decreases with the more able candidates qualifying their answer with reference to examples or calculations using spheres or cubes.

(b) Following on from the principles raised in **part (a)** candidates were required to explain why large active organisms need to have transport systems. There were many good answers along the lines of diffusion not being adequate as there is not enough area in relative to volume of organisms and that diffusion distance became too great for cells deep in body. This led on to descriptions of mass flow system being needed with pumping action of a heart to transport blood to the various parts of the body. Better candidates made reference to substances needing to be transported and to the high metabolic rate of large active animals.

(c) Finally candidates were asked to describe gaseous exchange in a named marine organism. The examples expected - coral polyps, grouper and tuna are all mentioned in the specifications. Different points were required for each example. All three examples were used by candidates taking the paper. For coral polyps the points being looked for included simple diffusion over the whole body surface, reference to diploblastic (two body layers) of coral polyps providing a short diffusion distance and plenty of contact with sea water. Stronger candidates referred to the low level of activity and low metabolic rate of coral polyps. For grouper points looked for included details of pumped ventilation, the buccal pump, moving water over the gills which are filled with blood capillaries and this oxygenated blood is then pumped around the body by the heart. Strong candidates went on to refer to the high metabolic rate of such fish. The third example used tuna, required points such as ram ventilation, the force generated by swimming forcing water over the gills followed by similar points to that in the grouper.