

# MARINE SCIENCE

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Paper 5180/01  
Structured

## Key Messages

It is important that candidates pay careful attention to all parts of the question asked, to the mark allocation and to the command word, all of which give information regarding the detail which needs to be included in responses. In several cases, questions asked for two parts to an answer (e.g. a description and an example), but many candidates gave only one or the other. The command word 'explain' requires candidates to give reasons for something and a description cannot be credited, no matter how detailed it is. On the other hand, 'describe' requires candidates to identify the main points of the topic, such as a process or the trends shown within some data. The number of lines provided gives further information as to the extent of the response required.

## General Comments

Most candidates were able to access the questions and many produced appropriate responses. These responses were usually well-written and in generally good English. Centres are reminded to instruct candidates to give their answers in English. Writing was of a good standard in most cases.

It is evident that weaker candidates had not read some of the more demanding questions well enough and did not answer the questions in the way they had been asked.

Candidates appeared to have no difficulty completing the paper in the time allotted as there were no reported cases of a candidate not answering all the questions on the paper.

## Comments on Specific Questions

### Question 1

- (a) Many candidates gave one of the acceptable answers, such as light or the Sun itself. However the most common incorrect answer by far was phytoplankton, showing that these candidates either did not understand the meaning of source, or did not consider phytoplankton to be part of the food web.
- (b) (i) This part proved challenging for most candidates. Many candidates referred to the level or the energy level in the food web, without focussing on the key idea that trophic refers to feeding. Relatively few candidates therefore gave the full description of feeding level in a food chain/web.
- (ii) This part was well done with most candidates realising that producers photosynthesise or produce food. Most candidates were able to give the correct example. There were many good descriptions of the details of photosynthesis, but these were not required.
- (iii) Two elements were required here, the idea of hunting or catching, along with the prey being eaten or used as food. Many candidates gave only one of these ideas. However, with the exception of those who mixed predators and prey, most gave appropriate examples. It should be noted that phytoplankton are not considered to be prey organisms. Some candidates failed to follow the rubric and gave examples which were not from the food web shown in the paper – such examples were not accepted.

- (c) Weaker candidates sometimes suggested that energy losses were 90% between each level or the converse that only 10% of energy is passed on, but went no further to explain how these losses were incurred. Although respiration was an acceptable alternative to heat, it was not acceptable to say that energy is used for respiration, rather than it being lost through respiration. Many candidates had clearly learned the causes of energy losses from a food web and gave good responses.

## Question 2

- (a) Many candidates completed the table accurately. Where candidates were sometimes confused it was most often between gastropods and cephalopods.
- (b) The great majority of candidates identified either the streamlined shape or tapering from head to tail as similarities between the two species, with almost none identifying the less obvious silver belly.
- (c) Weaker candidates gave answers lacking explanation, such as stating that colour may change, without explaining why this might be or simply stated that different fish have the same colour, when they may have meant that different *species* have the same colour.

## Question 3

- (a) (i) Many candidates referred either to the protection of gills or to the pumping of water, although infrequently gave both. It was relatively rare for candidates to describe the operculum as a cover.
- (ii) Gas exchange was by far the most common response, although better candidates referred to both gases involved in the exchange along with the direction of their movement. Candidates rarely referred to osmoregulation in one way or another.
- (iii) The function of the heart was well known by all but the very weakest of candidates, who often stopped at the heart being a pump, without reference to what it pumped.
- (iv) The function of scales as protection was well known, with some candidates adding the idea of reducing drag. Very few referred to species or mate recognition.
- (b) Good knowledge of technical terms such as gametes, larvae and juvenile was shown, although some believed that eggs were not formed until after fertilisation. Some weaker candidates misinterpreted the question as asking about the migration of fish. Diagrams were acceptable as an alternative to prose, although, for clarity, these also required annotation. Those candidates who drew diagrams usually added prose descriptions as well.

## Question 4

- (a) Most candidates were able to interpret the diagrams correctly, and gave the correct letter sequence in the table. Those who did not get the complete sequence were credited for identifying sequential pairs of stages in the development of the Earth's land masses.
- (b) Tectonics was well known, with a few candidates offering the acceptable alternative of continental drift.
- (c) (i) It was common for candidates to describe the effects of tsunamis here or to describe how a tsunami developed after its formation. However, the question focussed only on the formation of tsunamis. Consequently these candidates gained partial credit only. Many candidates referred to plates being involved and to either the displacement of large volumes of water and/or to the suddenness of the displacement. Earthquakes were also frequently given, but unfortunately it was often unclear in responses that these earthquakes needed to be underwater or in the sea bed. Good answers referred to subduction, either using this correct term or giving a description of one plate moving below another (which would also gain credit for reference to plates). Those candidates who described tsunamis as being large waves, or described how the characteristics of the wave changes as it approaches land, did not gain credit.

- (ii) The most common correct answers referred to loss of life and destruction of buildings. Flooding, erosion and habitat destruction were also frequently offered.

### Question 5

- (a)(i) Many candidates realised that antibiotics would prevent disease or kill bacteria, although weaker candidates referred to possible secondary effects of the action of the antibiotic, suggesting that antibiotics would help fish grow faster or simply be healthy. Only the best candidates were aware of antibiotic resistance or the possible high price of antibiotics, so relatively few gained full credit.
- (ii) The majority of candidates only stated that adding food pellets would provide food for fish. Few candidates made a reference to higher, rather than just high growth rate. Other than cost, few candidates could offer any disadvantage of the procedure.
- (b)(i) Most candidates recognised the need to subtract the production in 1970 from that in 2000, although reading the values from the graph proved difficult for the weakest candidates. Only a small minority of candidates realised that they then had to divide their answer by 30, to get the rate of increase per year, as required by the question. Most candidates gained some credit for quoting the correct unit, millions of tonnes, irrespective of the numerical answer.
- (ii) Increased demand was frequently given but few candidates gained full credit here, often referring to modern fish farms being better, without qualifying what this meant, or that they simply had more fish in them.
- (c)(i) Most candidates recognised that a market is a place and that selling or buying goes on at a market.
- (ii) Many candidates referred to exchange of goods or services, often giving appropriate examples of such a trade, however only better candidates went on to explain that no money was involved in the transaction.
- (iii) To gain full credit, candidates needed to define both of the words, 'national' and 'trade'. There was often confusion regarding the meaning of national, with some stating that it meant international or that it was between countries.

### Question 6

- (a) A number of candidates gave their responses in Dhivehi and could not be credited. Although most candidates correctly identified part A as the sail, many other parts of a boat were offered, including, commonly, tiller.

The tiller, part B, was also sometimes named as the sail, as candidates possibly mixed up the labels. Rudder was also a common error here.

#### (b)(i)–(iv)

Many candidates gained full credit here. Perhaps the most common misconception was that lights would help steering in thick fog.

- (c) Most candidates realised that boatyards are involved with building boats and repairing and maintaining boats. Many also suggested timber storage or the launching or hauling of boats. There were relatively few suggestions of the provision of chandlery (or examples of this), of waste disposal or the provision of utilities – although all of these gained credit when given. Unloading of fish or other goods or as a docking facility were not considered to be the roles of a boatyard.

### Question 7

- (a) Almost all candidates answered this question correctly.
- (b) Many candidates misinterpreted the focus of this question and only *described* the changes in oxygen concentration, with depth. Unfortunately this gained no credit as the question had asked for an *explanation* of the changes. Those candidates who answered the question as it had been set

frequently referred to variation in light, phytoplankton and/or temperature with depth. Further detail explaining the effect of these on oxygen concentration, including references to photosynthesis and its production of oxygen and to the effect of temperature on oxygen solubility were frequently referred to. Relatively few candidates referred to the effect of turbulence at the surface or that at depth there would be more oxygen used in respiration than was produced by photosynthesis.

### Question 8

- (a) This was well answered by most candidates. A range of synonyms for extinct were accepted, although having low numbers, without further detail, was not considered to be sufficient. Weaker candidates often confused endangered with dangerous or described endangered animals as being those which are already extinct.
- (b)(i) This was answered correctly by most candidates. It was usually unclear how those candidates who arrived at the wrong answer had completed their calculations and so no common error could be identified.
- (ii) Those candidates who confined their response to the parameters of the question usually gained full credit here. Some candidates only gave the overall change in Hawksbill nest numbers and could only gain partial credit. Candidates who went beyond the parameters of the question, perhaps describing the changes of total numbers of turtle nests, describing the wrong species or including 2005 in their answer were able to gain credit if they included the relevant information about Hawksbill turtles.
- (iii) There were many good answers here, with frequent references to legislation regarding turtle or egg collection. Sanctuaries and nest protection were also often seen, although vague answers such as stating laws and protection without qualification as to what the specific law concerned or what was being protected, did not gain credit.

### Question 9

- (a) (i) There was confusion about the roles of bacteria and enzymes in autolysis. Weaker candidates did not explain how the enzymes spoil the fish, for example by breaking down the tissues.
- (ii) Weaker candidates only stated that there were three stages, pre-rigor, rigor and post-rigor and failed to state what is meant by the term in question. Better candidates added to the stiffening of the fish by stating that this occurs after death.
- (b) Putrefaction was misinterpreted by some candidates as preservation, and these candidates went on to describe various processes, such as canning and the use of ice. Better candidates realised that they needed to describe the action of bacteria and the consequences of there being large numbers due to reproduction, not just growth, on the tissues of the fish. TMA production and unpleasant smells (not just fishy smells) were also often described, although relatively few candidates explained that bacteria release toxins.

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Paper 5180/02  
Paper 2

## Key Messages

- Candidates should read questions very carefully before writing their answers in order to ensure that they are addressing the actual questions posed.
- The use of the correct key scientific vocabulary will help candidates to produce precise answers.
- Candidates should show all working when carrying out calculations and be careful to include units.

## General Comments

The standard of answers was good. Candidates produced graphs carefully and accurately, taking care to label axes and draw straight lines, although many did not appreciate the need for linear scales. Some candidates found applying their knowledge to different contexts challenging.

## Comments on Specific Questions

### **Section A**

#### **Question 1**

- (a) The majority of candidates correctly calculated the tuna catch. Where candidates did not answer correctly, it was typically for miscalculating the total.
- (b) (i) Nearly all candidates were able to identify 2005 as the year with the highest catch of tuna by pole and line fishing.
- (ii) The majority of candidates were able to correctly calculate 226 315 tonnes. Where candidates made errors, it was typically for not including units or by selecting the wrong data in the calculation.
- (iii) This was answered correctly by many candidates. However, some candidates thought that the calculation necessitated adding the catch for every year together, and some thought that an average per year was required.
- (iv) Stronger candidates generally answered this question well and demonstrated that they fully understood how to calculate percentages. A number were confused as to which of the numbers should be the numerator and the denominator. Several candidates incorrectly rounded their answer to 7.81 rather than 7.82.
- (c) The majority of candidates appreciated that the overall trend was an increase in catch.
- (d) Many candidates gained full credit. The most common correct answers given were for the ideas of overfishing, bycatch and coral reef damage. A few candidates did not gain full credit due to giving answers that were vague, such as “catch of small fish” rather than juveniles or “catching endangered fish” rather than the idea of bycatch. Candidates should try to use precise language.
- (e) This question was challenging for most candidates. It required candidates to apply their knowledge of FADs and consider their effects on the marine environment. Many candidates simply described

what FADs are and how they attract fish. Some candidates gave very good answers in the correct context, often referring to damage of coral reefs, over fishing, migration of fish, toxin accumulation and some gave excellent accounts of species (including predators) accumulating in ecologically unsuitable areas.

## Question 2

- (a) Most candidates understood how to calculate a mean, although a few transcribed numbers from the table incorrectly. A number of candidates did not give units.
- (b) (i) Graph skills continue to be strong. The majority of candidates take care over plotting, labelling of axes and using a ruler to draw lines. The scale for the x-axis caused problems for many candidates with a number not using a linear scale. Linear scales are usually required for all graphs at this level.
- (ii) Most candidates were able to use the graph appropriately to read off the salinity and depth. Some were not accurate when ruling lines to the axes and so reached incorrect values. Others did not use the scales correctly or chose a scale that was difficult to interpret.
- (iii) Only the strongest candidates gained full credit for this question. Most correctly stated that salinity increased with increasing depth, but very few gave more detail. Candidates should be careful to look for turning points on graphs, or tables of data, and describe them appropriately. Simply giving values from a graph with no further detail will not usually gain credit and candidates should use values to identify turning points or manipulate them.
- (iv) Most candidates found this question challenging with few having a good understanding of how salinity affects the density of water. Many thought that factors such as temperature caused the gradient in salinity and some thought that solid salt crystals precipitated and sank to the bottom.
- (c) Stronger candidates answered this part of the question well. Weaker candidates gave vague references to temperature, light and oxygen levels.

## Section B

### Question 3

- (a) Most candidates had an understanding that genetic engineering involves some form of modification of genes or transfer of genes between different species. Some gave vague references to the changing of organisms and a few candidates were confused with general boat engineering and gave accounts of engines.
- (b) There were a significant number of candidates who did not seem to have encountered the term *polynucleotide*. However, some candidates gave excellent definitions explaining the large number of nucleotides (which some candidates correctly named), how they were joined and correctly stated DNA or RNA. Some candidates were very confused about the bonding involved and others thought that the question was about proteins. Some wrote very imprecise answers, and referred to the “bonding of multiple monomers of DNA”. Candidates should try to use very clear terminology when answering technical questions such as this.
- (c) (i) The majority of candidates found this question very challenging. Where candidates had clearly studied the topic, they often gave detailed answers that fully explained the microinjection of the gene into trout eggs. There was, however, great confusion shown in many answers. A large number of candidates thought that trout were injected with hormones. Some thought the question was about selective breeding while others described physically altering muscle tissue and some discussed the engineering of engines.
- (ii) The strongest candidates answered this question well. Some candidates gave vague answers that discussed human impact on the environment such as greenhouse gas production, and others gave generic answers concerning fish farming. Many focused their answers towards only one half of the question (either environment or escape) rather than giving a balance to both aspects. Where candidates gained credit, it was typically for the ideas of rapid fish growth, consumer rejection and the consequences on the environment of escape of the fish.

**Question 4**

- (a) Most candidates gained some credit on this question, although the quality of response varied greatly. A significant number of candidates did not read the question carefully enough and gave accounts of the life cycle of coral polyps rather than the internal structure. A number of candidates did not refer to zooxanthellae and tended to not use technical terms such as nematocysts or mesenteries. Some candidates confused the word coralline with corallite. There were some excellent, detailed accounts that did, however, use full technical language and these often gained full credit. Most understood the roles of the tentacles in feeding and defence.
- (b) Most candidates gained some credit on this question, often for the idea of habitat loss, but only stronger candidates gained full credit. Some answers gave very vague accounts of reef damage simply damaging the homes of fish and reducing their numbers. Good answers gave specific points such as habitat loss, effect on food chains, migration of fish away from the reef and loss of commercial species such as bait fish.

# MARINE SCIENCE

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<p><b>Paper 5180/03</b> <b>Practical Assessment Paper 3</b></p>
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## Key messages

- Candidates need to be familiar with all of the core practical elements included in the syllabus document, and to have undertaken as many of these as possible in order to develop their practical scientific skills.
- Candidates need to carefully follow the instructions given in the question, and understand the command words used to ensure they answer the question fully.

## General comments

Candidates who did well ensured that their lines to label features touched precisely the correct feature. They had also carefully drawn a scale line and had used guide lines to accurately draw it below the specimen. Stronger candidates were thorough in their answers, including the full colour changes in food tests, and paid attention to units in tables/graphs and numerical answers.

## Comments on specific questions

### *Section A*

#### **Question 1**

- (a) Drawings were usually of a good size, with many candidates achieving a good body shape too. However, the majority of candidates did not notice that this was a demersal (or flat) fish, and did not include two eyes on the dorsal surface of the fish. The question states “Do not show the markings of the fish”, however, several candidates did this, which may have given them less time to complete the remaining questions well.
- (b) The majority of candidates labelled the caudal and dorsal fin accurately, but often labelled the operculum where the gill was showing. Candidates should be encouraged to ensure their label line touches the edge of the feature they are labelling.
- (c) (i) Many candidates had some difficulty drawing the scale line, or including the correct measurement to put on the scale line, with many writing down the length of their drawing rather than the given actual length of the specimen.
- (ii) Many candidates knew the correct formula for magnification, but then used their drawing length for the calculation rather than the length of the specimen in the photograph.

#### **Question 2**

- (a) (i) The vast majority of candidates were familiar with these two specimens, with many candidates giving the class of arthropod as well, which was not required.
- (ii) The majority of candidates completed this question well, although a significant number did not follow the instructions which stated a tick if the feature was present, and a cross if it was not present.



- (b)(i) A large proportion of candidates completed this accurately. However, a significant number did not look at the table headings and so measured the shells and recorded them in centimeters rather than millimeters.
- (ii) This question was generally completed well, with the main error being that candidates failed to include their units for full credit. If candidates are not given the units on the mark line, they should include them.

### Question 3

- (a) While many candidates knew the test to carry out, and the final colour of the solution, many failed to state the actual change from pink to violet. Simply stating it turns violet (or purple/lilac) did not gain full credit here. Candidates should be encouraged to state the original colour as well as the colour it changes to for a positive test.
- (b) Again, many candidates knew the correct test to do. Some forgot to mention heating it and others stated place in a water bath, but did not mention a temperature or a hot/warm water bath. Several missed the final mark for not stating that the colour had changed from blue to brick-red (or green/yellow/orange).
- (c) Many candidates were unsure of this test, simply re-stating the Benedict's test from (b), or suggested using ethanol/iodine to test for it. Only the strongest candidates knew the difference between the two tests. Candidates need to be able to carry out both types of test and understand the need to break down the non-reducing sugar using acid before neutralising and carrying out the Benedict's test.

### Question 4

- (a) The vast majority of candidates drew neat, accurate tables, with the most common error being failing to include units with the headings of the table, often writing the units beside each value given in the table. While some candidates did not rank the data at all, others ranked just the diameter of the trunk, and not the height that went with it. Therefore the data was no longer linked together and in some cases this followed through onto their graphs too.
- (b) Most candidates answered well, with the most common error being to extend the line of best fit beyond the points plotted, and to fail to label the axes with the units as well as the label. For the line of best fit, a significant number of candidates drew lines from point to point.
- (c) This was well answered, although some candidates simply wrote "positive" rather than stating the relationship between tree height and diameter.

### Question 5

- (a) This was generally answered well. The main errors in methods used were: failing to state a length of rope to use, not stating that they record the time taken, failing to repeat and find the mean, stating they need to do the investigation on the same day/time of day. A variety of safety precautions were mentioned, and many suggested carrying out the investigation on both North and South sides of the island. Some candidates did not fully understand that their method needed to be in this section, and only included their equipment, describing most of their method in (b).
- (b) Many drew a suitable table with appropriate headings. Some candidates made it clear there would be repeats at each site, and included calculation of a mean. A few candidates suggested a suitable graph, with some stating "draw a graph" or "draw a line or bar graph", but answers needed to be specific about it being a bar chart. Many candidates stated the results showed a higher current speed on the North side of the island, but only a very small number of candidates related the results back to the hypothesis.
- (c) A number of very general answers were seen for this question and some showed a lack of understanding of the term 'limitation'. Some candidates discussed the problems of the wind on the investigation, and many suggested doing the investigation at different times of year or at other sites, such as a different island or East and West sides of the island. While some candidates stated "anomalous results", they showed little understanding of what these were or what to do about them. Candidates needed to understand to look, or check their results, for anomalous

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results that didn't fit with the rest of the results, and to ignore them when calculating the mean, or to repeat the investigation if it was noticed when they were doing the investigation.