MARINE SCIENCE

Paper 0697/11
Theory and Data Handling

There were too few candidates for a meaningful report to be produced.

MARINE SCIENCE

Paper 0697/12
Theory and Data Handling

Key messages

Candidates need to ensure they have read the questions carefully and should attempt all questions.

Candidates need to develop the skill of linking different aspects of the curriculum to provide a full answer to some questions.

An area requiring development is aquaculture and understanding that the generic principles in the specification can be applied to different species.

General comments

Candidates were generally well prepared for the examination, attempted most of the questions and appeared to have manged their examination time well. Many candidates demonstrated an excellent knowledge and understanding from across the syllabus, and there were some excellent answers provided. Candidates generally understood the scientific terminology in the questions and used scientific terms accurately in their answers.

Comments on specific questions

Question 1

(a) (i) Most candidates achieved partial credit with many achieving full credit. The most common error was stating the turtle returned to the beach where she was born rather than where she was hatched. Candidates also needed to state that a nest was dug or excavated for full credit.

(ii) Full or partial credit was achieved by most candidates, with a range of methods given. The most common error was stating 'from memory', as most of the methods of navigation require memory.

(iii) Most candidates were able to achieve full or partial credit, often for pollution, usually with some form of plastics pollution given. Some candidates did not gain full credit as they made suggestions such as that people were loud rather than stating noise pollution or just suggested light without explaining that it was light pollution or light from the tourist activities disturbing the turtles. A number of candidates suggested people walking on top of the nest would cause problems. However, the nests are covered with sand so a person walking above them will not cause an issue. Candidates also gave egg collection or turtles being captured for food, hotels being built on the land and a small number of candidates suggested that the tourists may disturb the nesting turtles.

(iv) Although many candidates achieved credit on this question, some candidates found it difficult to explain what a marine protected area was without using the term 'protected'. Candidates needed to give the idea that these areas are carefully controlled in terms of activities that can take place within them.

(b) Most candidates were able to achieve credit here. The most common error was stating abiotic rather than biotic factors.

Question 2

(a) Most candidates achieved partial credit here with many achieving full credit. The most common error was mixing up habitat and ecosystem.

(b) (i) The majority of candidates gave the correct answer of Indian Ocean. The most common error was stating Pacific Ocean.

(ii) Candidates often achieved partial credit for this question. Candidates were often able to state that a sea was a smaller area of the ocean, but few could correctly explain that seas are partially enclosed by coast or land, often saying that land surrounded them or that seas were found by the coast.

(iii) Candidates found this question more challenging. Only few candidates were able to explain that there are more nutrients in area **Y** due to run-off or coastal upwellings. A significant number of candidates made statements such as that there are more phytoplankton present without stating that they had an increased growth rate.

Question 3

(a) (i) The majority of candidates correctly identified cell wall, cytoplasm and cell membrane. The most common error was mixing up cell wall and cell membrane.

(ii) Many candidates were able to correctly state that this structure controls or allows the movement of substances into or out of the cell. The most common error was stating that it was for cell protection.

(iii) Many candidates achieved credit for giving vacuole or chloroplast. Some candidates incorrectly gave chlorophyll rather than chloroplast and others stated a nucleus, which is present in animal cells as well, indicating they may not have paid close enough attention to the question.

(iv) This question was generally answered better than **(iii)** with candidates giving mitochondria or nucleus.

(b) (i) Many candidates correctly stated it was to make proteins or amino acids or for growth. The most common error was stating it was for energy or for nutrients.

(ii) Many candidates were able to state that bacteria were decomposers or give a named process that bacteria are involved in. However, some candidates did not consider the question sufficiently as they did not explain how this is important in the nitrogen cycle and did not state that the nutrients are turned into a form that can be absorbed by organisms. Some candidates stated that the bacteria form simpler molecules, which could have been credited if they then also said that these are then absorbed by producers. Some candidates went into far greater detail than required.

Question 4

(a) (i) Many candidates gave the correct answer of the Sun. Some of the common incorrect answers included ‘wind’, ‘kinetic energy’ or ‘light’.

(ii) The majority of candidates correctly identified **B**, with the most common incorrect answer being **C**.

(iii) Most candidates achieved full or partial credit, usually for stating the particles slowed down or lost energy.

(b) Many candidates were able to gain full or partial credit. The most frequently seen correct answer was in relation to global warming or climate change, with the second most commonly seen answer referring to carbon dioxide being released by the burning of fossil fuels. To gain full credit, candidates needed to link the increased temperatures to greater evaporation causing an increase in rainfall. Some candidates achieved partial credit and then stated ‘so there is more precipitation’, for which they did not gain full credit, as the link to increased evaporation was missing.

Question 5

(a) Many candidates correctly identified the mouth and tentacles for partial credit. Many candidates also stated that protection was provided by the calcium carbonate skeleton. Some candidates had more difficulty in explaining the function of the tentacles and the mouth.

(b) This question asked about differences between sexual and asexual reproduction in coral polyps. Some candidates stated generic differences between sexual and asexual reproduction which limited the credit available. The question linked two aspects of the syllabus, 3.2 and 3.6.2. Some candidates did not gain credit as they referred to male and female sex cells but did not make any comment regarding external fertilisation or the release of gametes. Many candidates referred to asexual reproduction in terms of budding or fragmentation to achieve further credit.

(c) (i) Most candidates gained full or partial credit, with a common error being the magnitude of their answer, e.g. giving 412 000 or stating it in incorrect standard form e.g. 4.12×10^{3}.

(ii) Candidates often gave a good explanation explaining why coral polyps at a greater depth would have fewer zooxanthellae present in them, usually referring to the reduced amount of light available for photosynthesis. Some candidates did not achieve credit for stating that there was 'no sunlight', as with no sunlight there would be no zooxanthellae present.

(iii) Only stronger candidates considered what might reduce the light level, temperature or pH for the species at a shallower depth. Some candidates were able to give a suitable explanation for the condition that changed and gained full credit. Some candidates gave a change in conditions that would reduce photosynthesis but did not go on to explain their answer.

Question 6

(a) (i) Most candidates achieved at least partial credit for correctly stating the two values read from the graph. A few candidates did not read the graph accurately enough. Many candidates also completed the subtraction correctly, but some candidates immediately divided the two values. Some candidates then divided their answer by the value for 2010 rather than that for 1990 to calculate the percentage change. A few candidates divided by another number altogether, and it was often not clear where this value had come from.

(ii) Many candidates achieved partial credit here, often for stating that the fish stock or the fish population had increased. Many candidates just stated 'improved technology' without giving examples of that improved technology. This could have been in terms of boat size or the type of fishing gear being used (net sizes or methods, or mesh size) or for a named technology such as sonar to help locate fish.

(b) (i) Most candidates achieved partial credit here, usually for mentioning that algae or phytoplankton grow on or below the FAD. Some candidates were awarded only partial credit as they were less precise in their answer, simply stating that the FAD attracted fish. Some candidates said that boats would go there to catch fish but did not suggest that more boats would go there or that it was easier or quicker to catch the fish there.

(ii) This question required candidates to suggest two named management strategies that would help in maintaining fish stocks in order for the fishery to remain viable in the long term. Some candidates did not take note of the phrase 'long term' and only referred to using larger boats or smaller mesh in order to increase the fish catch in the short term only.

Question 7

(a) (i) Some candidates did not give an answer for this question. Many candidates drew a line starting further to the right of the existing line and showed a thermocline. Only stronger candidates gained full credit for sketching a temperature–depth curve which also finished close to the existing line.

(ii) Only few candidates knew the depth of the Mariana trench.

(iii) The majority of candidates achieved full or partial credit, with most candidates being able to state that the temperature was low or that the pressure was high. Some candidates did not achieve full credit as they stated 'low light' instead of 'no light', or gave 'little to no light'.

(b) (i) Some candidates achieved partial credit, and a few achieved full credit. Partial credit was usually achieved through stating that the eyes of these organisms are not useful when there is no sunlight. Only stronger candidates suggested that bioluminescent organisms would require sight in order to see the prey that their bioluminescent light attracts.

(ii) Many candidates answered this correctly, but some only stated ‘due to the pressure’ without any detail if this was a high or a low pressure.

Question 8

(a) Some candidates mentioned that sustainability was about leaving resources to be available for future generations, but fewer were able to desribe the idea that materials can still be harvested but at a rate that does not deplete the resource.

(b) (i) This question was often poorly answered as many candidates did not show a clear understanding of the processes involved in aquaculture. Some candidates achieved partial credit, usually for reference to feeding the fish, maintaining water quality through filtration and size sorting of fish to prevent cannibalism. A few candidates mentioned controlling disease or parasites through treatment with antibiotics or by having cleaner species. Only very few candidates mentioned selecting the original broodstock from healthy wild populations or selecting further broodfish from the fastest growing or healthiest individuals.

(ii) Only the strongest performing candidates answered this fully with others sometimes achieving partial credit, often for mentioning that eutrophication leads to reduced oxygen in the water which can kill the fish.

MARINE SCIENCE

Paper 0697/13
Theory and Data Handling

There were too few candidates for a meaningful report to be produced.

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Paper 0697/21
Theory and Practical Skills

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MARINE SCIENCE

Paper 0697/22
Theory and Practical Skills

Key messages

In future series, candidates should:

- always include full, accurate scientific terminology in their answers
- be clear on the requirements of each command word listed in the syllabus
- be clear on the definitions of practical vocabulary, such as 'accurate', 'reliable', and 'valid'
- be clear on the guidance for biological drawings, e.g. using pencil, drawing unbroken lines and not adding shading
- understand how to plan valid practical investigations.

General comments

Candidates demonstrated an excellent understanding of all the topics and skills on the new syllabus. Factual knowledge from all areas of the syllabus was often excellent and many candidates used scientific vocabulary confidently and accurately. Most candidates had a full understanding of all the practicals covered on the paper and had strong generic skills. It is important for candidates to know the details of all the practicals listed in the syllabus topics and also the generic practical skills, such as how to plan valid investigations.

Biological drawing skills and graph plotting skills were generally excellent, but a few candidates needed to follow the requirements of biological drawings, such as using no shading and the use of pencil. Data analysis was generally very strong, but a few candidates confused the command words of 'describe' and 'explain'. Candidates should be fully familiar with the different requirement of all the command words, as listed in the syllabus.

Most candidates also demonstrated strong mathematical skills.

Most candidates attempted every question and most produced answers of appropriate length. Candidates should always look at the mark allocation for each question as a guide to how much detail is needed.

Comments on specific questions

Question 1

(a) (i) This question required candidates to identify three areas of the seabed. Most correctly identified **A** as the continental slope, and **B** as the abyssal plane. Stronger candidates went on to correctly identify **C** as the mid-ocean ridge, but a significant number suggested that it was a volcano.

(ii) This question was answered well by many candidates with most gaining at least partial credit and a significant number going on to gain full credit. Most candidates recognised that the present-day continents started as one super-continent, Pangea, and then split apart. Stronger answers explained that this happened over a period of time that stretched for millions of years and that the plates float on the magma. These candidates also explained that convection currents in the magma cause the movement of the plates. Weaker answers often simply described the nature of the different plate boundaries and how they cause earthquakes.

(b) (i) Most candidates were able to gain full credit here and it was clear that candidates generally had strong mathematical skills. A few candidates did not give their final answer to one decimal place. Candidates should be careful to read all parts of each question.

(ii) This question generated some outstanding answers with many candidates gaining at least partial credit and many going on to gain full credit. Stronger answers described the attachment of a rope to a floating object, such as a bottle half-filled with sand, and went on to describe how it would be released into the water and the distance and time measured. Many candidates went on to explain how the speed would be calculated and stated that it would be repeated to calculate a mean. A few candidates gave answers that lacked detail, simply stating that objects would be placed into the water and the speed that they travelled measured. If practical methods are asked for, candidates should give full practical details.

(iii) Many candidates found this final part of the question challenging. The command word was 'evaluate' which means that for full credit, candidates needed to list points that both supported and opposed the conclusion. Many recognised that the current speeds were very similar, so this supported the conclusion. Stronger answers went on to state that there were no actual values for the night and/or there should be more data obtained between the times to make a stronger conclusion. Some candidates also correctly stated that other factors such as wind speed and tides would affect current speed. Candidates should be reminded to organise their answers to evaluation questions so that it is clear what they consider supports or opposes the argument.

Question 2

(a) Many candidates correctly stated that nets are cast from boats and that the boats circle around shoals of fish before ropes are pulled to draw the net closed around the fish. Some candidates confused purse seine fishing with trawling and suggested that the net is towed from the back of the boat for long distances or that the net is towed along the seabed. The syllabus lists several methods of fishing that candidates need to know.

(b) (i) There was a high standard of drawing, and many candidates presented drawings that had unbroken lines, had no shading, were in proportion and were at least as large as the photograph. Candidates should use pencils for their drawings and should check the requirements for drawing skills listed in the syllabus.

(ii) Most candidates were able to correctly identify the caudal fish and went on to state that its main function is to generate thrust.

(iii) Most candidates were able to correctly calculate the length of the mackerel using the magnification factor. A few candidates did not convert units correctly and others did not give their answer to the nearest whole number.

(iv) Many candidates gained at least partial credit with a significant number of candidates going on to gain full credit. Common errors included stating that Eukarya represented phyla rather than domain, and that the kingdom was fish rather than animalia. Some candidates incorrectly used a lower-case letter 's' for the genus or a capital 'S' for the species.

(c) (i) Most candidates were able to identify at least one abiotic condition of the sunlight zone, usually high light intensity. Many candidates gained full credit. Some candidates recognised abiotic factors but did not give enough detail, for example, stating 'temperature', rather than 'variable temperature', or stating 'oxygen' rather than 'high oxygen'. A few candidates incorrectly suggested biotic factors such as food presence.

(ii) Many candidates were able to gain at least partial credit here and some gave excellent answers that explained how the different colouration of the ventral and dorsal surface of the mackerel enables it to escape detection by predators. Some candidates correctly stated that species need to be fast or streamlined for hunting or to escape predation and others correctly stated that many species are migratory. Where candidates did not gain full credit, it was typically for only giving descriptions when the question asked for an explanation.

Question 3

(a) This question was correctly answered by many candidates. But some candidates confused the supratidal and subtidal areas, whilst others referred to high and low tide areas rather than the terms listed in the syllabus.

(b) (i) This question was generally answered well by many candidates. Stronger answers referred to the setting up of a transect, the use of quadrats and the systematic placement of the quadrats along the transect. Some candidates incorrectly referred to quadrants or simply referred to squares. Another common error was to describe random sampling of the shore rather than systematic sampling.

(ii) Many candidates correctly stated that it would be impossible to count individual macroalgae, so percentage cover was a better measure. Some candidates gave vague answers, such as stating that percentage cover is quicker or easier. Candidates are advised to always give specific details.

(iii) Many candidates found this question challenging. Stronger candidates described how the limpet population decreased from subtidal zone and suggested reasons such as exposure, predator number or lack of food supply which was macroalgae. Many candidates suggested abiotic factors that would affect the distribution of the limpets but did not link the explanations to the data. Stronger candidates linked their explanations to patterns in the data.

(c) This question was well answered by many candidates with most gaining at least partial credit. Stronger candidates explained that the sea anemones attach to rocks to prevent dislodging and can retract their tentacles to avoid dehydration. Some candidates clearly confused sea anemones with echinoderms, incorrectly referring to hard, spiky bodies. Candidates should ensure that they cover all the examples of organisms listed in the syllabus.

Question 4

(a) (i) Stronger candidates were able to extract data from the table and use it to calculate the total mass of plastic released from continent **F**. The final answer had to be rounded to the nearest whole number and given in tonnes. Some candidates did not convert the units correctly or round the figure correctly. Both of these skills are listed in the syllabus mathematical requirements.

(ii) Most candidates drew excellent bar charts and gained at least partial credit. Many candidates were able to draw neat bars that had gaps between them and plotted the bars accurately. A small number of candidates incorrectly drew line graphs, and some did not produce a linear scale that enabled the graph to use more than half of the grid. Most candidates were able to label the axes with units correctly.

(iii) Many candidates were able to suggest a reason for the reduced release of plastic in continent **C** compared with continent **B**. Many correctly suggested that there may be more recycling schemes or that continent **B** may have a higher use of unrecyclable plastics.

(b) (i) Most candidates were able to correctly state the equation for photosynthesis. A few candidates incorrectly included light rather than water or carbon dioxide on the left-hand side.

(ii) Most candidates correctly stated an abiotic variable, and many went on to give a method of controlling it. The most common suggestion was the use of a water bath to control the temperature. A few candidates correctly stated that hydrogen carbonate could be used to control the level of carbon dioxide.

(iii) The standard of table drawing was very high. Most candidates drew tables that had all the data and headers within the box, but a few did not draw complete boxes with ruled lines. Most also correctly placed units in the headers and not in the body of the table. The majority of candidates also correctly ordered the data.

(iv) Most candidates were able to gain at least partial credit for stating that the light intensity would be reduced and that this would lower photosynthesis, reducing food for higher levels of food chains. Some candidates misread the question and commented on the generic dangers of plastic to organisms in the oceans.

(v) This question assessed candidates' understanding of how to improve experimental accuracy. Most strong answers stated that bubble counting is an inaccurate measure and that collecting a volume of oxygen would be more accurate. Many candidates also correctly suggested appropriate methods such as the use of a gas syringe. Some candidates did not clearly refer to how accuracy could be improved but incorrectly referred to repeats. Candidates should make sure that they have a full understanding of practical terminology.

Question 5

(a) (i) This question was answered well with most candidates correctly identifying vitamin D or calcium as a micronutrient. A few candidates simply stated ‘vitamins’ rather than identifying vitamin D in the table.

(ii) Stronger candidates explained that iron is required for the synthesis of haemoglobin and that this enables the transport of oxygen. Most candidates were able to gain at least partial credit with many going on to gain full credit.

(b) Many excellent answers to this question were seen that explained how the apparatus would be set up, gave safety precautions (such as the use of eye protection), listed standardised variables and explained how the dependent variable would be measured. The strongest answers also explained that the mass of fish would need to be kept the same, or measured, to enable a valid comparison. Weaker responses often gave an incorrect practical, such as the measurement of fat using emulsion tests, but sometimes gained partial credit for the ideas of standardised variables, safety precautions and repeats. When planning practicals, candidates should always include standardised variables, experimental details, a method of changing the independent variable, and a method of measuring the dependent variable.

Question 6

(a) (i) Many candidates incorrectly referred to the amount of salt rather than the concentration of salt. Candidates needed to avoid using vague terms such as amount and focus answers on terms such as concentration, mass or volume. Many candidates gained partial credit for correctly stating the unit of salinity as parts per thousand or ppt. There are several definitions listed in the syllabus and candidates should be familiar with all of them.

(ii) This question was answered well with most candidates being able to read the data from the graph and correctly subtract the values.

(b) This challenging question was answered well with many candidates gaining at least partial credit. Stronger candidates recognised that water in the Arctic would be colder and so have more oxygen and that in the summer meltwater from glaciers would enter the ocean reducing the salinity. Many candidates also went on to correctly state that equatorial water would be warmer so evaporation would be higher, leading to a higher salinity and less oxygen. Weaker responses tended to simply describe the data from the graph. The question asked for an explanation, so candidates needed to ensure that their answer gave reasons for the data patterns.

(c) Many candidates were able to correctly state that universal indicator (paper) would be used to compare the pH. A number of candidates incorrectly stated that pH paper (rather than universal indicator paper) or litmus paper would be used. Fewer candidates went on to describe the expected colour changes or that a pH colour chart would be used to ascertain the pH of the solutions.

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Paper 0697/23
Theory and Practical Skills

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