

Principal examiner reports for teachers

Principal examiner reports for teachers summarise what candidates did well and what candidates needed to improve for this examination series only.

This report is to be used in conjunction with the question paper and mark scheme.

For guidance on teaching and learning we provide resources for many of our syllabuses.

Resource	Where to find it
Grade descriptions – Grade descriptions describe the level of performance typically demonstrated by candidates achieving the different grades awarded for a qualification.	School support hub Select: Subject > Resource finder > Syllabus and specimen materials
Schemes of work – Schemes of work are designed to support you in your teaching and lesson planning.	School support hub Select: Subject > Resource finder > Teaching and learning
Lesson planning – Guidance on how to plan a lesson.	Lesson planning
Resource plus – There may be additional resources such as teaching packs containing lesson plans, resources and worksheets and videos for aspects of your syllabus.	School support hub Select: Subject > Resource finder > Teaching and learning
Teaching tools	Teaching Tools
Exemplar candidate responses	School support hub Select: Subject > Resource finder > Teaching and learning
Learner guide – A guide for students to help them understand what the course involves.	School support hub Select: Subject > Resource finder > Teaching and learning
Community forums – Do you have a question or something to share? Our online forums are great way to keep up to date with your subject and the global Cambridge community.	Community forum on the school support hub
Access to scripts for this series.	Access to scripts service
Results analysis is available for some syllabuses.	Results analysis
Test maker is available for some subjects.	Test maker

Other services from Cambridge International Education

- [Digital mocks service](#)
- [Insight assessments](#)
- [Professional development](#)
 - [Focus on assessment](#)
 - [Online marking workshops](#)

MARINE SCIENCE

Paper 0697/12
Theory and Data Handling

Key messages

What candidates did well

- Candidates generally demonstrated a very good underpinning knowledge from the specification, answering recall questions very well, such as **Questions 1(a)(i), 2(a), 3(a)(i), 5(a) and (b)**.
- Candidates managed their time very well, with few question omissions from candidates.
- Many candidates structured their answers carefully, showing a logical progression through their answer, such as for **Question 3(c)** on eutrophication.
- Some candidates did use bullet points for **Question 8(b)**. Each bullet point was a full sentence giving the required details and linked important points together.

What candidates needed to improve

- Some candidates need to develop their skills in application of their knowledge to novel situations. Candidates should consider the keywords in the stem and apply the knowledge to the situation given.
- Some candidates need to read the question carefully especially when there are explain questions and ensure they have explained their answer.
- Some candidates need to consider the context of the question more in order to provide relevant answers.
- A few candidates used short bullet points for **Question 8(b)** that did not always link to some of their other bullet points, so their answers were not clear.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Most candidates matched some or all of the processes with their descriptions.

Limited responses

- The most common error was misidentifying the description of condensation.

(ii) Comprehensive responses

- Many candidates understood that kinetic energy decreases, or that energy decreases, when water freezes.

Limited responses

- A few candidates stated that kinetic energy decreased and potential energy increased, implying the energy remained in the water molecules.

(b) (i) Comprehensive responses

- Some candidates stated that the salinity increases, as freshwater enters the ocean.
- Some candidates stated that the salinity of the ocean water would decrease as the freshwater entered the ocean.

Limited responses

- Some candidates stated 'salinity decreases' without making clear that the ocean water salinity decreases.

(ii) Comprehensive responses

- Many candidates demonstrated a good understanding of how the tidal cycle changed the salinity in an estuary, and discussed the sea water input causing this.

Limited responses

- A few candidates thought that the salinity increased at low tide as there was less water present.
- A few candidates thought the salinity increased at low tide as more water evaporated at low tide leaving the salt behind.
- A few candidates confused spring and neap tides with high and low tides.

(iii) Comprehensive responses

- Some candidates clearly stated that solubility decreases with increasing temperature or gave kinetic theory to explain why warm water holds less gas.
- A few candidates stated that the river water would cool as it entered the ocean.

Limited responses

- Many candidates thought that solubility of gases was the same as solubility of solids, and so stated that more gases dissolved at a higher temperature.

(iv) Comprehensive responses

- A few candidates gave a detailed explanation which included some kinetic theory to explain why warm water is less dense than cold water. A few others mentioned the effect of salinity on density of river water compared to seawater as well as the effect of the temperature.

Limited responses

- Many candidates stated that warm water is less dense than cold water rather than explaining this with the required detail. Candidates need to develop ideas of how kinetic theory can be applied to explain some observations.

Question 2

(a) Comprehensive responses

- Most candidates identified the different areas of the cross section of an ocean.

Limited responses

- The most common errors were stating just 'volcano' for **G** ('underwater volcano' was given a BOD) or 'continental shelf' for **E**.

(b)(i) Comprehensive responses

- Some candidates knew the Mariana Trench is 11 000 m deep.

Limited responses

- Some candidates gave Km as the units rather than m. Many candidates gave a random number or did not apply the appropriate unit for their depth.

(ii) Comprehensive responses

- Many candidates understood there was no light in the Mariana Trench, fewer also stated that this meant photosynthesis could not occur there.

Limited responses

- A few candidates said there was low light, or little to no light in the Mariana Trench, which did not provide sufficient detail.

(iii) Comprehensive responses

- Many candidates stated one or two adaptations of deep water marine species, with the most common answer being bioluminescence.

Limited responses

- Some candidates mentioned large, outward facing or sharp teeth rather than backward facing teeth, or gave general answers such as large jaws or camouflage or named species living there. Candidates need to give accurate responses rather than vague statements.

Question 3

(a) (i) Comprehensive responses

- Most candidates gave a correct feature of molluscs, most commonly having a shell.

Limited responses

- A few candidates gave a general response such as slimy, have tentacles or soft bodies.

(ii) Comprehensive responses

- Some candidates had read the question carefully and gave responses that caused a decrease in the population of Olympia oysters, such as decreased food supply, a new predator or a new disease.

Limited responses

- Some candidates only stated factors that would affect population size, such as predation or harvesting unqualified. Candidates were required to apply this knowledge to the cause of a reduced population size.

(b) (i) Comprehensive responses

- A few candidates completed the calculation correctly, showing their full working.

Limited responses

- A few candidates rounded their answer down or left their answer with a decimal place.
- Many candidates did not complete all parts of the calculation, often due to dividing 50 000 by only 7.2 or only 250, rather than dividing by both 7.2 and 250.

(ii) Comprehensive responses

- Many candidates completed the calculation correctly, recognising that 85 per cent of the oysters survived.

Limited responses

- A few candidates calculated the number of oysters that had died rather than how many remained after a year.
- Some candidates did not show any working and wrote down a number without showing any working.

(c) Comprehensive responses

- Many candidates had a clear understanding of the process of eutrophication and gave comprehensive responses which included all the main points.
- Many candidates structured their response carefully, going through the process in a logical sequence.

Limited responses

- A few candidates gave responses that mentioned increased nutrients, they also needed to state where these had come from.
- Some candidates did not give further detail once an algal bloom had occurred, so had not explained about decomposers using oxygen in the water, nor that the bacterial decomposers used the oxygen for aerobic respiration.

(d) Comprehensive responses

- A few candidates stated that the wild population would increase, with fewer also stating that this was because of reduced fishing effort on the wild population, or that the commercial growers would be able to produce oysters for release to aid recovery of the wild populations.

Limited responses

- Many stated that the population of Olympia oyster would increase, rather than that the population of wild oysters would be able to increase when they are reared commercially due to reduced fishing of the wild population.
- Many candidates restated information given in the stem of the question.

Question 4

(a) (i) Comprehensive responses

- Some candidates understood that area **M** was closer to rivers bringing run-off and nutrients to the area, with fewer also stating that this provided nutrients for producers to have greater rates of photosynthesis.
- A few candidates did explain that due to the shallow depth, more producers were able to attach to the seabed and gain light for increased photosynthesis.

Limited responses

- Many candidates stated that there was more light due to the water being shallow, without recognising that light penetration in the open ocean can be high to significant depths, or that run off from rivers may make coastal areas more turbid.
- Some candidates stated there would be more nutrients, they also needed to state where these had come from.

(ii) Comprehensive responses

- Many candidates recognised that higher primary productivity would lead to a greater catch of fish, with fewer mentioning this was due to increased energy being passed along the food chain.

Limited responses

- Several candidates talked about increased profits, more jobs or fish being caught faster which were not sufficient.

(iii) Comprehensive responses

- A few candidates recognised that organisms may be affected by higher pollution or ingestion of microplastics in the area due to its proximity to run-off bringing pollutants to the area, or the impact on food chains or biodiversity.

Limited responses

- Many candidates suggested overfishing or bycatch.

(b) Comprehensive responses

- Most candidates knew that GPS was used to locate the boats position, with many also knowing the uses of sonar and radar.
- Few candidates mentioned both chart and compass for plotting a course, often only mentioning one of these.

Limited responses

- A few candidates confused sonar and radar or gave the same answer to all four situations.

Question 5

(a) Comprehensive responses

- Most candidates identified an adaptation of the banded archerfish from the photograph. Most commonly, they mentioned the dark bands for camouflage or the specially shaped mouth to allow them to spit at their prey and knock them into the water.

Limited responses

- A few candidates gave counter current shading rather than the disruptive bands, and giving camouflage. Others mentioned general features of fish, such as an operculum or fins, and their functions.

(b) Comprehensive responses

- Many candidates were able to state at least one biotic factor affecting the fish population.

Limited responses

- A few candidates gave abiotic factors such as temperature or salinity.

(c) (i) Comprehensive responses

- Many candidates suggested at least one way that mangrove forests are of benefit to humans.
- Most commonly candidates mentioned coastal protection or being an area of food supply.

Limited responses

- A few candidates stated 'mangroves reduces waves' or 'mangroves reduces wind' without stating how this is of benefit to people in terms of reduced erosion.
- Many candidates mentioned removal of carbon dioxide from the air, rather than the long term storage of carbon in their structures.
- Some candidates stated 'provides building materials' without stating what materials they would be.

(ii) Comprehensive responses

- A few candidates explained their answers, most often for new infrastructure reducing the habitat, or deforestation causing climate change.

Limited responses

- Many candidates only named impacts, such as overfishing, trees being cut down or pollution, without explaining what the impact of these are on the forests.

Question 6

(a) (i) Comprehensive responses

- Many candidates mentioned returning to the shore the turtle had hatched on, with fewer making it clear it was the female coming ashore to lay eggs.
- Fewer candidates gave the 10-day interval between laying eggs.

Limited responses

- Some candidates mentioned migration or stated that the turtles stayed to 'guard' their eggs or to look after the eggs in some way.

(ii) Comprehensive responses

- Many candidates stated that the gender of the turtles is determined by the temperature they were incubated at, or that higher temperature caused more females to hatch.

Limited responses

- Some candidates did not make it explicit that it is the temperature of incubation that determines the gender, which could mean that the turtles could change gender due to temperature changes after hatching.

(iii) Comprehensive responses

- Many candidates were able to compare sexual with asexual reproduction, giving clear differences in terms of two parents for sexual, and one parent for asexual, or that the offspring had features of both parents in sexual reproduction, and asexual produced clones or identical individuals.

Limited responses

- A few candidates only talked about one side, so giving two parents and features of both, then did not mention asexual at all, so not explaining the differences.

(b) (i) Comprehensive responses

- Many candidates linked the presence of more iron in the blood to an increased level of haemoglobin, with slightly fewer stating this led to more oxygen being held in the blood.
- A few candidates just linked increased iron in the blood to more oxygen.

Limited responses

- Some candidates stated they held their breath for a longer time period and did not use the information provided to them.

(ii) Comprehensive responses

- Most candidates stated that light penetration decreases with increasing depth.

Limited responses

- Very few candidates were not clear, in that they made statements such as 'light doesn't reach below 1000m' rather than stating the general pattern.

(iii) Comprehensive responses

- Most candidates stated that the pressure increased with increasing depth, with some giving further explanation of why.

Limited responses

- A few candidates mentioned other factors than pressure and depth.

(iv) Comprehensive responses

- Most candidates knew and clearly expressed in detail how oxygen concentration changed with depth.
- A few candidates explained why this happened, usually mentioning the lack of light reducing photosynthesis.

Limited responses

- A few candidates did not link the lack of light to lack of photosynthesis,

(c) (i) Comprehensive responses

- Many candidates correctly identified the two features drawing label lines carefully to ensure they touched the features.

Limited responses

- A few candidates omitted this question
- A few candidates did not have their line touching the feature, sometimes stopping just before it, or for the cell membrane, overshooting the feature. Candidates should ensure they draw their line without arrowheads and that they touch the feature.

(ii) Comprehensive responses

- Many candidates stated the function of the cell membrane accurately.

Limited responses

- A few candidates gave the function of a cell wall, to protect the cell.

Question 7

(a) (i) Comprehensive responses

- Some candidates gave comprehensive answers describing how several factors would be different between sandy and rocky shores.
- The most common responses were for describing how wave action, substrate stability or particle sizes on the shores were different.

Limited responses

- A few candidates stated how abiotic factors may be different, such as organisms have a muscular foot to attach to the rocky shore, or suggested that salinity or light penetration would differ.
- A few candidates listed different abiotic factors for each shore, without describing any differences in those factors between the shores.

(ii) Comprehensive responses

- Most candidates stated sandy shores with many explaining some of their adaptations, most commonly living in burrows and have specialised haemoglobin to survive in low oxygen environments.

Limited responses

- A few candidates only stated sandy shores without giving any explanation for this.
- Some candidates stated that lugworms eat the sand to gain nutrients without showing the understanding that the nutrition came from the microorganisms living on the sand particles. Candidates need to be explicit in their answers.

(b) Comprehensive responses

- Many candidates demonstrated a good knowledge of this process understanding that water from the depths rose to the surface waters during upwelling.

Limited responses

- Many candidates did not clearly explain the role of the wind in the process, with many stating that the wind blew the water, then they did not state that this is an offshore wind.

Question 8

(a) Comprehensive responses

- Many candidates clearly described one or two impacts of plastics, most commonly organisms eating plastics and starving or animals becoming entangled in plastics and dying due to suffocation or starvation.

Limited responses

- Some candidates stated the problem, not the impact it had. They mentioned animals eating the plastic or becoming entangled, then not stating the consequence of these.

(b) Comprehensive responses

- Most candidates were able to provide some suggestions for strategies to reduce pollution in oceans, with some giving very comprehensive and well-planned responses, covering a range of strategies.

Limited responses

- A few candidates provided quite vague answers, or their answers did not include the detail required.

MARINE SCIENCE

Paper 0697/22
Theory and Practical Skills

Key messages

This paper has a focus on practical science with additional questions on candidates' knowledge and understanding of theory, and application of candidates' knowledge to unfamiliar data. Understanding of factual knowledge was generally very good and many candidates used scientific vocabulary. Limited responses tended to underuse key scientific vocabulary and/or not give the specific details listed in the syllabus. Understanding of most of the core practicals listed in the syllabus was generally very good and many candidates demonstrated clear understanding of the generic practical skills such as drawing and planning experiments. Limited responses to practical questions tended to show less recall of the core practicals or did not clearly identify standardised variables. Application of knowledge to unfamiliar data is an area that candidates in future series could focus on as some candidates tended to not give accurate descriptions of data and/or explanations. Many candidates demonstrated excellent mathematical skills, excellent graph drawing skills and could interpret data well. Understanding of command words was generally very good, although some candidates were unclear as to the distinction between command words such as 'explain', 'describe', and 'discuss'. In future series, candidates should always ensure that they fully understand all command words.

What candidates did well

- Many gave accurate, detailed answers that contained excellent scientific vocabulary.
- Drawing skills were excellent with most candidates presenting carefully constructed drawings that were the appropriate size, drawn with pencil, and had no shading.
- Graph skills were excellent with many candidates producing carefully constructed bar charts with accurate plots, an appropriate linear axis, and correctly labelled axes.
- Many candidates demonstrated excellent knowledge of the core practicals listed in the syllabus and excellent understanding of how to plan well controlled, valid practicals.
- Mathematical skills were generally excellent with many candidates able to calculate percentages and magnifications.

What candidates needed to improve

- Some candidates should make sure that they have a full understanding of all the different command words used in this syllabus.
- Some candidates should make sure that their knowledge and understanding of all topics in the syllabus has sufficient detail.
- Some candidates should ensure that they understand how to plan well controlled, valid investigations.
- Some candidates need to have a full knowledge of all the core practicals listed in the syllabus.
- Some candidates need to approach unfamiliar data more effectively, describe patterns accurately and then suggest explanations for patterns.
- All candidates need to make sure that they show all their working for mathematical calculations.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Presented drawings with clear, unbroken outlines with no shading.
- Created drawings that were at least as large as the original photograph.
- Created drawings that had all the key features that were in the correct proportions.

Limited responses

- Did not follow the instructions to only draw the area inside the box.
- Made drawings with lines that were sketchy or had breaks.
- Missed features, such as a leg, that were present inside the box.
- Did not draw diagrams that were in the correct proportion. For example, the front legs were longer than the antennae.

(ii) Comprehensive responses

- Measured the line accurately and in centimetres.

Limited responses

- Did not measure the line accurately or used incorrect units.

(iii) Comprehensive responses

- Correctly calculated the size of the line in centimetres and gave their answer to the nearest whole number.

Limited responses

- Used the magnification formula incorrectly so did not obtain the correct final answer.
- Did not give their answer to the nearest whole number. Candidates should be careful to read questions fully.

(iii) Comprehensive responses

- Correctly recognised that the isopod had abdominal segments with jointed legs, bilateral symmetry, an exoskeleton and no setae.

Limited responses

- Did not appreciate that setae were absent.

(iv) Comprehensive responses

- Correctly identified the domain as Eukarya.
- Correctly identified the invertebrate group as Crustacea.

Limited responses

- Incorrectly identified the domain, often as bacteria, animals or invertebrates.
- Incorrectly identified the invertebrate group, often as annelids.

(b)(i) Comprehensive responses

- Stated that detritivores are animals.
- Stated that detritivores gain energy from dead organic material.

Limited responses

- Referred to organisms rather than animals.
- Often confused detritivores with decomposer microbes.

(ii) Comprehensive responses

- Gave clear, well-structured answers that referred to absence of light, absence of producers and no photosynthesis.
- Clearly referred to marine snow falling to the seabed to provide energy.

Limited responses

- Often gave vague statements such as 'the midnight zone has harsh conditions' without specifically referring to the absence of light.
- Did not explain why an absence of light is a problem for food chains in the midnight zone.

Question 2

(a)(i) Comprehensive responses

- Correctly applied the key to derive the concentration of plastic in the area.

Limited responses

- Often used the scale for latitude incorrectly.

(ii) Comprehensive responses

- Described that the highest concentration of plastic was in the centre of the patch.
- Referred to the asymmetry of the garbage patch.
- Identified the number of areas with the highest concentrations.

Limited responses

- Often gave only one descriptive point such as the highest concentration being in the centre.

(ii) Comprehensive responses

- Correctly identified another gyre, such as the South Atlantic gyre.

Limited responses

- Gave a vague answer, such as the Atlantic gyre.
- Referred to the same gyre as stated in the question stem.

(iv) Comprehensive responses

- Stated that gyres have rotating currents of water.
- Explained that the currents are formed by factors such as wind.
- Described how the currents move plastic into the centre of the gyres.
- Described how the rotating currents prevent plastic from being released from the gyres.

Limited responses

- Often did not specifically refer to water currents.
- Often did not fully describe how the currents rotate.
- Often referred to the idea of currents moving plastic but did not describe how the currents move plastic to the centres of the gyres.

(b)(i) Comprehensive responses

- Labelled all axes with units.
- Accurately plotted all bars.
- Used a linear y-axis that enabled the bars to cover at least half of the grid.
- Drew graphs with a key for the two data series.
- Drew graphs which had neat bars with gaps between them.

Limited responses

- Sometimes used a non-linear y-axis.
- Sometimes misplotted the bars.
- Sometimes did not label the axes.
- Sometimes used a scale that did not enable the bars to cover at least half of the grid.

(ii) Comprehensive responses

- Described the increase in mean mass of plastic in both series of data.
- Manipulated the data by completing calculations.
- Stated that the mass in the GPGP was always higher than outside the GPGP.

Limited responses

- Often only referred to an increase or the mass being higher in the GPGP.
- Often did not use a calculation to support their answer.

(iii) Comprehensive responses

- Recognised that sampling would need to be random to avoid bias.
- Suggested the standardisation of several variables such as date of sampling, time of sampling and method used to collect plastic.

Limited responses

- Often did not mention the standardisation of variables.
- Often did not recognise that sampling would need to be random to avoid bias.

Question 3

(a) (i) Comprehensive responses

- Gave a detailed definition that included a reference to all species, and the interaction of the organisms with their environment.

Limited responses

- Often did not refer to all species.
- Often did not refer to the interaction with the environment.

(ii) Comprehensive responses

- Listed two clearly different types of ecosystems such as rocky shores and seagrass meadows.

Limited responses

- Some stated mangrove forest which was given in the question stem.
- Some referred to both sedimentary shores and sandy shores.
- Some gave alternative ecosystems that were not coastal ecosystems.

(b) (i) Comprehensive responses

- Calculated the decrease in mangroves correctly and then divided this by the initial area of forest.
- Gave the final answer to the nearest whole number.

Limited responses

- Often incorrectly used the final area as the denominator.
- Often did not give their final answer to the nearest whole number.

(b) (ii) Comprehensive responses

- Stated a correct adaptation such as pneumatophores or salt excretion by leaves.
- Gave an answer that explained the named adaptation, such as pneumatophores enabling gas exchange or the uptake of oxygen.

Limited responses

- Often gave generic plant adaptations.
- Often correctly named pneumatophores but did not extend the answer to explain the role of the pneumatophores.
- Sometimes confused gas exchange with the process of respiration.

(c) (ii) Comprehensive responses

- Referred to the lowering of a Secchi disc into the water until it disappears.
- Stated that the Secchi disc should be brought back up again until visible and the distance determined.
- Described how to calculate the mean depth.

Limited responses

- Often did not mention the use of a Secchi disc.
- Often did not refer to lowering the disc into the water until not seen.
- Sometimes gave the wrong method such as measuring the mass of particles in the water.

Question 4

(a) (i) Comprehensive responses

- Described how ranging poles are used at two places along a shore.
- Described how a group of students would line up the ranging poles and then use a clinometer to measure the angle of elevation.
- Described how this would be repeated along the whole length of the shore.

Limited responses

- Often described an incorrect method, frequently the use of a transect to measure population changes or the use of random quadrats to determine populations.
- Often referred to the use of a clinometer or protractor but did not state that this would enable the angle of elevation to be determined.

(ii) Comprehensive responses

- Gave appropriate measures such as the use of shoes with gripping soles, a knowledge of the tide times, or working in a group.

Limited responses

- Often gave vague answers such as the use of protective clothing.
- Sometimes referred to inappropriate measures such as the use of a lab coat.

(b)(i) Comprehensive responses

- Described the general increase in height.
- Referred to the key turning points, such as the steep rise between 0 m and 2 m or the level off in height after 8 m.

Limited responses

- Often only described the increase in height without referring to the key data points.
- Sometimes described the wrong graph.

(ii) Comprehensive responses

- Used the first graph to determine the distance along the shore.
- Used the distance along the shore to determine the percentage cover with mussels.
- Showed their working.

Limited responses

- Sometimes did not attempt the question.
- Sometimes determined the distance along the shore but not the percentage cover.
- Often did not include working.

(iii) Comprehensive responses

- Gave a thorough description of how the mussel cover changed from the low tide, thus putting their answer into the correct context.
- Described how abiotic factors would change along the shore, such as increased exposure with greater distance from the low tide level.
- Listed several abiotic factors that would change along the shore, such as temperature stability, and wave action.
- Explained how mussels can close their shells to reduce dehydration.

Limited responses

- Often did not answer the question in the context of the data.
- Often listed abiotic factors but did not link them to the mussel cover along the shore.
- Gave incorrect adaptations of mussels, such as suggesting that tube feet or muscular feet anchor them to rocks.

Question 5

(a) (i) Comprehensive responses

- Described the use of nets or cages in open systems or the use of tanks in closed systems.

Limited responses

- Often gave vague answers such as open systems being used in open water.

(ii) Comprehensive responses

- Described the roles of water currents in supplying oxygen, maintaining salinity and removing wastes.
- Described how low stocking densities and not overfeeding fish would reduce disease spread.
- Described how separating fish by age would reduce cannibalism.
- Described how using substances such as antibiotics would reduce the growth of harmful bacteria.

Limited responses

- Often gave vague answers that described aquaculture but did not refer to the specific roles of water currents in removing wastes and bringing in fresh oxygen.

(b)(i) Comprehensive responses

- Stated that oxygen is needed for respiration.
- Stated that respiration is needed for the release of energy.
- Gave a reason why fish need the energy, such as for movement.

Limited responses

- Often did not refer to respiration.
- Sometimes only stated that the fish would die without oxygen rather than explained why a lack of oxygen is a problem.

(b)(ii) Comprehensive responses

- Gave a detailed description of how carbonated water can be weighed before and after heating.
- Gave a detailed description of the equipment that would be used and what variables would be standardised.

Limited responses

- Often described an incorrect experiment, such as the effect of carbon dioxide gas on pH.
- Often did not describe the use of carbonated water.

(c) Comprehensive responses

- Correctly identified protein and lipids.

Limited responses

- Gave incorrect substances, such as starch.

Question 6

(a)(i) Comprehensive responses

- Correctly added carbon dioxide, water, and glucose to the equation.

Limited responses

- Sometimes, incorrectly, wrote glucose on the left side of the equation.

(ii) Comprehensive responses

- Correctly stated chlorophyll.

Limited responses

- Often referred to chloroplasts rather than chlorophyll.

(iii) Comprehensive responses

- Described the use of universal indicator solution or universal indicator paper.
- Gave correct colour changes, such as red in acid.
- Described how to compare the colour of the solution with a chart.

Limited responses

- Often gave vague answers, such as the use of indicator rather than universal indicator.
- Often referred to comparing the colour to a pH scale rather than a colour chart.

(b)

Comprehensive responses

- Stated a range of pHs that would be used.
- Described a method to measure rate of photosynthesis, such as counting bubbles or collecting a volume of oxygen.
- Suggested variables that would need to be standardised, such as light intensity, carbon dioxide concentration, or temperature.
- Gave practical details, such as having pond weed with the cut side pointing upwards, or using a funnel to collect the oxygen.
- Referred to the use of replicates to ensure validity.
- Gave a safety precaution, such as the use of eye protection.

Limited responses

- Some answers were not practical plans but explanations of how pH might affect photosynthesis.
- Some answers did not give variables that would need to be standardised.
- Some answers gave no methods for measuring the rate of photosynthesis.
- Some answers did not refer to replication of the experiment.