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Examiners' Report
June 2019

IGCSE Single Science 4SS0 1B

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Introduction

This is the first time that the new qualification has been offered. Examiners saw a range of responses on the items from outstanding to weak. There was no evidence of students being short of time and most students attempted all items. Students did especially well on the experiment design item and the sketch of a bar chart. Items that proved most challenging included the probablity item and the explanation of different respiration rates in different size chickens. Many students also struggled to correctly apply the magnification formula.

Question 1 (a) (ii)

In question Q01 students were given a diagram of a plant cell. In Q01aii most reponses correctly identified the organelle that makes ATP as a mitochondrion.

Question 1 (c) (i)

In item Q01ci most students could name an organelle found in plant cells but not in animal cells. Students should note that the cell wall is not an organelle.

Question 1 (c) (ii)

In item Q01cii most responses did not correctly give a location for genetic materlal in a bacterium. Suitable correct answers given included plasmid, cytoplasm and a circular chromosome.

Question 2 (a)

Item Q02a gave students a table to complete containing some information about different enzymes. Most responses gained some credit with the best ones correctly naming protease and restriction as the enzymes, convesrion of maltose to glucose as the function and digestion as the process.

2 Enzymes are involved in many processes.

(a) The table gives some information about different enzymes.

Complete the table by giving the missing information.

(4)

Enzyme	Function	Name of process
Protease	breakdown of protein into amino acids	digestion
maltase	Breakdown maltose into glucose.	digestion
Restriction enzyme	to cut DNA	genetic modification

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Examiner Comments

This response scores all 4 marks.

2 Enzymes are involved in many processes.

(a) The table gives some information about different enzymes.

Complete the table by giving the missing information.

(4)

Enzyme	Function	Name of process
Protease	breakdown of protein into amino acids	digestion
maltase	break down of maltose	digestion
~~Amylase~~ lipase	to cut DNA	genetic modification

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Examiner Comments

This response scores 2 marks for protease and digestion.

Question 2 (b) (ii)

In Q02bii most responses gained 1 mark for stating that the enzyme works better at pH 2.5. Fewer went on to explain that this is due to the enzyme denaturing at low pH thus preventing the substrate binding with the active site. Some students were confused by the graph and wrote about temperature and kinetic energy.

(ii) Explain the difference in the rate of digestion by enzyme P at pH 1.0 and pH 2.5

(2)

The rate of digestion at pH 1.0 is lower than compared to pH at 2.5, as lower the pH, the enzymes denatures and so the ~~subst~~ active site changes the shape and the substrate cannot bind with the active site, reducing the activity of the enzyme, and as a result, reducing the rate of digestion as well.

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Examiner Comments

This excellent response scores 2 marks, but makes all 3 marking points. Stating that the rate is lower at pH 1 and explaining that this is due to the enzyme denaturing and the active site changes shape. They then explain that the substrate can no longer bind.

(ii) Explain the difference in the rate of digestion by enzyme P at pH 1.0 and pH 2.5

(2)

The pH at 1.0 is too acidic for this enzyme thus the enzyme has been denatured and the active site doesn't work. The acidity at pH 2.5 is lower and the enzyme works better at this pH. 2.5 is the optimum pH for ths enzyme.

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Examiner Comments

This response also scores 2 marks for reference to the enzyme denaturing at pH 1 and that enzyme works better at pH 2.5.

Question 3 (a)

In Q03a students were given a diagram showing a red blood cell. They had to describe the differences between its structure and the structure of a white blood cell. Most students obtained some marks with many scoring 2 of the 3 marks available. The very best responses described red cells as being biconcave, having no nucleus and being smaller than white blood cells.

3 The diagram shows the appearance of a red blood cell.

(Source: © royaltystockphoto.com/Shutterstock)

(a) Describe how the structure of this cell is different from the structure of a white blood cell.

(3)

The red blood cell is smaller in size than the white blood cell. It has a biconcave shape to carry to oxygen carrying molecule haemoglobin. The red blood cell has a large surface area. The red blood cell has no nucleus to carry the haemoglobin.

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Examiner Comments

This response scores all 3 marking points.

3 The diagram shows the appearance of a red blood cell.

(Source: © royaltystockphoto.com/Shutterstock)

(a) Describe how the structure of this cell is different from the structure of a white blood cell.

(3)

Redblood cells have a biinere biconcave shape, have have no nucleus which frees up more space for haemoglobin and are smaller in size.

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Examiner Comments

This response also gains all 3 marks.

Question 3 (b) (i)

In item Q03bi students were given a description of an investigation into the effect of different solutions on red blood cells. Only the best students recognised that this question was about osmosis. They could then explain that when placed in water the water would enter the cells by osmosis and they would burst. Many weaker responses wrote about the cells dissolving in the water.

(b) A student investigates the effect of different solutions on red blood cells.

He places one drop of blood into each of three test tubes, A, B and C.

- test tube A contains water (high water potential)
- test tube B contains a dilute salt solution with the same concentration as plasma (same low water potential)
- test tube C contains a concentrated salt solution (low water potential)

After five minutes, the student places samples from each test tube on separate microscope slides.

He places each slide under a microscope and counts the number of red blood cells in each sample.

The table shows his results.

Test tube	Number of red blood cells
A	0
B	450
C	450

(i) Explain why the student does not see any cells in the sample from tube A.

(2)

Since Tube A contains water, it has a higher water potential than the water potential in the ~~red~~ red blood cells. This causes osmosis to occur, where the water particles from the water in the container travel into the red blood cell causing the cell to burst, resulting in its absence.

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Examiner Comments

This response scores 2 marks but contains all 3 marking points. It explains that osmosis occurs and that water enters the cell causing the cell to burst.

(b) A student investigates the effect of different solutions on red blood cells.

He places one drop of blood into each of three test tubes, A, B and C.

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After five minutes, the student places samples from each test tube on separate microscope slides.

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The table shows his results.

Test tube	Number of red blood cells
A	0
B	450
C	450

(i) Explain why the student does not see any cells in the sample from tube A.

(2)

This is because the ~~cell~~ contents inside the cell is of higher concentration so water ~~~~ moves into the cell by osmosis ~~and~~ to dilute it which causes it to ~~blast open as~~ burst open as it has no cell wall. to withstand the internal pressure.

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Examiner Comments

This response also contains all 3 marking points and scores 2 marks.

Question 3 (b) (ii)

In Q03bii Students had to draw a red blood cell as seen in the sample from the concentrated salt solution. About one third of responses gained credit for drawing a shrunken cell showing a crumpled appearance. Weaker students drew a test tube containing dots.

(ii) Draw the appearance of a red blood cell as seen in the sample from tube C.

(1)

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Examiner Comments

This response scores the mark as it shows a crumpled appearance.

Question 3 (c)

In item Q03c students were asked to calculate the total numer of red blood cells given the number in 1mm^3 of blood and a total bloood volume of 4dm^3. This required students to be able to use standard form and know the relationship between mm^3 and dm^3. Most scored 1mark but encountered problems with how many mm^3 in a dm^3.

(c) A person has 5×10^6 red blood cells in 1 mm^3 of blood.

The volume of blood in this person is 4 dm^3 (litres).

Calculate the total number of red blood cells in this person's blood.

(2)

$4dm^3 = 4000000\ mm^3$

$1mm^3 = 5 \times 10^6$ red blood cells

$4000000 = 2 \times 10^{13}$ red blood cells

$4000000 \times (5 \times 10^6) = 2 \times 10^{13}$

total number = 2×10^{13}

ResultsPlus
Examiner Comments

This response scores 2 marks for 2 x 10^{13} .

(c) A person has 5×10^6 red blood cells in 1 mm^3 of blood.

The volume of blood in this person is 4 dm^3 (litres).

Calculate the total number of red blood cells in this person's blood.

(2)

$4 \times 1000 \times 1000 \times 5 \times 10^6 = 2 \times 10^{13}$

$= 20000000000000$

total number = ...

ResultsPlus
Examiner Comments

This also scores 2 marks.

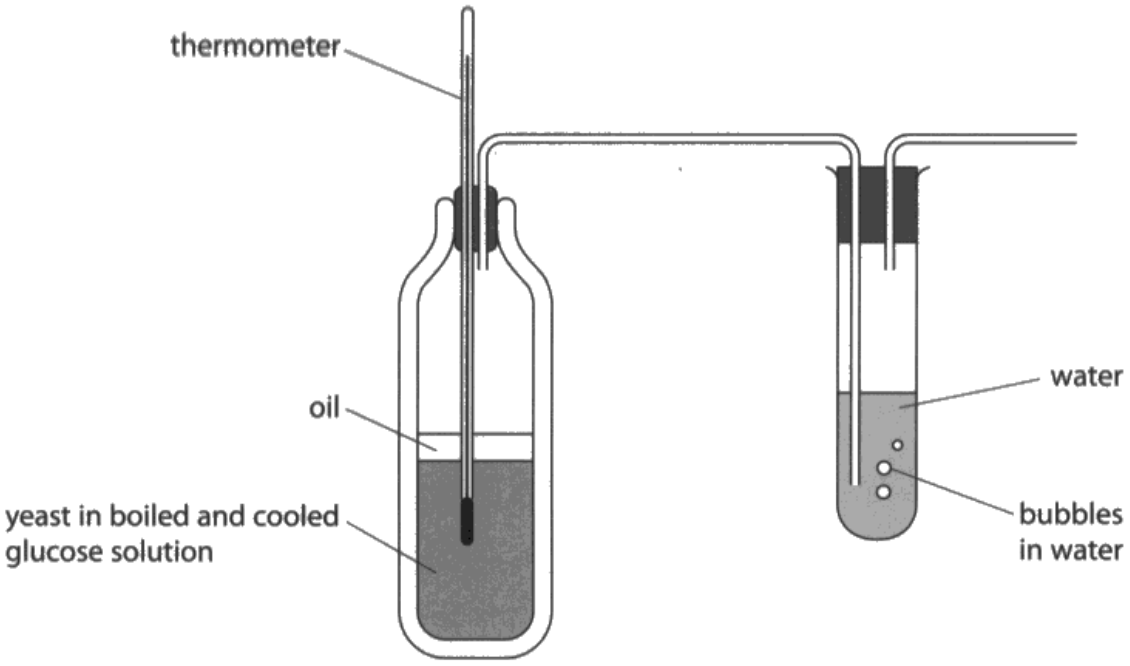
ResultsPlus
Examiner Tip

It would be easier to leave the answer in standard form.

Question 4 (a)

Item Q04a described an experiment to investigate the anaerobic respiration of yeast. This is a practical direct from the specification. So examiners were surprised that more responses could not explain why the glucose was boiled and then cooled before adding the yeast. The best responses were able to explain that the yeast was bolied to remove all of the oxygen or to kill any microorgnaisms present and then cooled so that the yeast is not killed and the enzymes are not denatured.

4 A student uses this apparatus to investigate anaerobic respiration by yeast.



(a) Explain why the student boils and cools the glucose solution before the yeast is added.

(2)

This is because anaerobic respiration takes place in the absence of oxygen, so by boiling it oxygen is now removed so conditions are anaerobic and it is ~~cotte~~ cooled to ensure that the ~~enzymes~~ only yeast (enzymes) do not get denatured.

ResultsPlus
Examiner Comments

This response scores both marks for boiling to remove oxygen and cooling to prevent the enzymes being denatured.

Question 4 (b)

In question Q04b students had to explain how the apparatus could be modified to obtain a more accurate measurement of the rate of anaerobic respiration. Again only a minority of responses gained full marks for explaining that the student could measure the volume of gas produced using a gas syringe or an inverted measuring cylinder.

(b) The student measures the rate of anaerobic respiration by counting the number of bubbles produced per minute.

Explain how she could modify her apparatus to obtain a more accurate measurement of the rate of anaerobic respiration.

(2)

Use a measuring gas syringe ✓ and get the answer interms of volume

ResultsPlus
Examiner Comments

This response scores both marks for using a gas syringe to measure volume.

Question 4 (c) (ii)

Q04cii asked students to sketch a bar chart to show the results of aeroboc and anaerobic respiration. Almost all responses gained full marks.

Question 5 (a) (i)

Q05ai gave students information about crosses between a family of giraffes. Many students were able to identify the genotypes of the parents as both heteroztgous required to produce an albino offspring.

(a) (i) Use information from the diagram to deduce the genotype of each parent.

(2)

In the diagram, it has shown that the first generation has 2 brown furred girrafes and 1 white furred giraffe, for a white furred giraffe to be born, heterozygose ~~alle~~ genes have to be with the parents so each parent has genotype ~~"Bg"~~, 'Bb'

ResultsPlus
Examiner Comments

This response scores both marks for correctly giving the genotype of each parent.

(a) (i) Use information from the diagram to deduce the genotype of each parent.

(2)

Parents: male female

Bb Bb

ResultsPlus
Examiner Comments

This response also scores both marks.

Question 5 (a) (ii)

This question asked students to state the maximum number of giraffes that could be homozygous dominant. Most responses were incorrect but a significant percentage could correctly state that 4 would be homozygous.

Question 5 (b)

This item Q05aii was one of the most demanding on the paper and only the best students were able to correctly determine the probability of a male with white fur as 0.5 x 0.25 so 0.125. The answer could be expressed as a decimal, fraction or as a percentage.

Question 5 (c)

Item Q05c asked students to explain why there are only a few white giraffes in the wild. Many students were able to answer this item correctly recognising the effect of natural selection due to white giraffes lacking camouflage and thus being less likely to survive and pass on the white allele to offspring.

(c) Explain why there are only a few giraffes with white fur in the wild.

(4)

~~Girra~~ Giraffes live in a habitat which mainly green and yellow colour plants. In this kind of habbitat a brown fur giraffe would be well camoflaged, while a white fura giraffe would be easily seen by predators which could hunt and kill them. As a result of ~~Hme~~ their low survival rate they don't get a ~~chaage~~ chance to reproduce and pass the allele for white fur to it offspring. Therefore the number of white fur ~~giree~~ giraffe are low.

ResultsPlus
Examiner Comments

This response scores 4 marks for reference to lack of camouflage therefore the giraffe not surviving and not reproducing and so not passing on the allele for white fur.

(c) Explain why there are only a few giraffes with white fur in the wild.

(4)

It is because of natural selection which means that ~~e~~ individuals in a population can survive because they are better adapted in the environment. So giraffes with brown fur can survive but not giraffes with white fur. Survived brown fur giraffes reproduce and pass their genes to the new generation. So the number of white fur giraffes decrease and number of brown fur giraffes increase.

ResultsPlus
Examiner Comments

This response also scores 4 marks. It refers to natural selection, the white giraffes not surviving so not reproducing but brown giraffes surviving, reproducing and passing the their genes on.

Question 6 (a)

Q06a required students to design an investigation to discover if chickens kept in sheds grow larger than chickens kept outside in fields. Almost all responses gained credit with the most commonly occuring score being 6 marks. These high scoring responses often used the CORMS prompt that enabled them to gain full marks.

6 Many farmers keep their chickens in sheds.

They claim that their chickens grow larger when kept in sheds rather than outside in fields.

(a) Design an investigation to test this claim.

Your answer should include experimental details and be written in full sentences.

(6)

same species, of the same ~~weight~~ mass and age. Take two sets of chickens and place one set in a shed and keep the other set of chickens outside in the fields and provide them with the same conditions like the same amount of food and the same feeding times and allow them to grow in the different environments for over six months and at the same time measure the mass of one chicken from the shed and the mass of a chicken from the outside fields and compare the two results to decide which environment is the best for the growth of chickens. The investigation has to be repeated for reliable results and ~~the~~ a mean value should be taken after ignoring anamalous results.

ResultsPlus
Examiner Comments

This very clear response scores 6 marks. It gains R, O, C, S1, M2 and M1.

ResultsPlus
Examiner Tip

The response could have been improved by stating the number of chickens in each set.

6 Many farmers keep their chickens in sheds.

They claim that their chickens grow larger when kept in sheds rather than outside in fields.

(a) Design an investigation to test this claim.

Your answer should include experimental details and be written in full sentences.

(6)

I would create too groups of chickens. One ~~group~~ group will be kept in a shed and the other will be kept outside in a field. All the chickens should be of the same gender, same species and have the same mass at the start of the experiment. ~~Then after a two weeks time period I will measure the new mass of the chickens using a scale. I will repeat the test to increase~~ I would also provide both groups the same food and amount of water, and will also provide them with the same amount of space. Then after a two week time period I will measure the new mass of the chickens of both groups, using a scale. Repeat the experiment to increase accuracy. These results will ~~allow me to~~ show ~~weather~~ which method allows the chickens to grow more ~~as~~, as the ~~method which allow~~ chickens ~~that~~ ~~was~~ would have a higher change in mass.

ResultsPlus
Examiner Comments

This excellent response also scores full marks. It actually makes all 7 marking points for a maximum score of 6. It scores in order R, C, O, S1, S2, M2 and M1.

Question 6 (c)

Q06c was difficult for candidates and only the best made the link between size and surface area to volume ratio. These reponses then went on to explain that smaller chickens would lose more heat and therefore need to have a higher respiration rate becuase of the energy used to maintain body temperature.

(c) Suggest why the respiration rate of a small chicken is higher than the respiration rate of a large chicken.

(4)

The smaller chicken has a larger surface area to volume ratio than the brger chicken, therefore it would be losing more heat energy via its skin. To keep their internal body temperatures constent to maintain the optimum temperature for its enzymes, it must have a higher respiration rate, so that it can release more energy from its ~~as heat.~~ food as heat.

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Examiner Comments

This scores 4 marks for small chickens having a larger surface area to volume ratio, therefore losing more heat. They also refer to using heat energy from respiration to maintain body temperature.

(c) Suggest why the respiration rate of a small chicken is higher than the respiration rate of a large chicken.

(4)

Small chicks ~~have~~ have a larger surface area to volume ratio, resulting in larger heat loss. Therefore, to maintain optimum temperate for themselves and enzymes, they must replace the heat lost. This is done through a higher rate of respiration allowing them to produce more energy to warm themselves. They need to respire more frequently.

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This response also scores all 4 marks for reference to larger surface area to volume ratio, more heat loss and using energy from respiration to maintain body temperature.

Question 7 (a) (i)

Item Q07ai required students to identify the part where oestrogen is produced. Most were able to do this.

Question 7 (a) (ii)

In Q07aii many students could give a role of oestrogen. Most common correct responses mentioned the development of a named secondary sexual characteristic.

Question 7 (b) (i)

Q07bi many students could correctly name the zygote as the cell produced when the egg is fertilised.

Question 7 (b) (ii)

Q07bii required students to calculate the time taken for a sperm to travel 14 cm if it swims at 3.0 mm aminute. About half of reponses gained at least 1 mark with common errors being not converting cm to mm or rounding errors. Some students rounded 46.7 to 46.

(ii) A sperm travels a distance of 14 cm to fertilise an egg.

This sperm travels at a speed of 3.0 mm per minute.

Calculate the time taken for this sperm to travel to the egg.

Give your answer in minutes.

(2)

$s = \frac{d}{t}$

$t = \frac{d}{s}$

$t = \frac{14\text{ cm}}{0.3\text{ cm}}$

$t =$

time = 46.7 minutes

ResultsPlus
Examiner Comments

This response scores both marks.

(ii) A sperm travels a distance of 14 cm to fertilise an egg.

This sperm travels at a speed of 3.0 mm per minute.

Calculate the time taken for this sperm to travel to the egg.

Give your answer in minutes.

$\frac{140}{3} = 46.6$ (2)

14 cm ⟶ 140 mm

3 mm ⟶ 1 minute

140 mm ⟶ ?

time = 46.7 minutes

ResultsPlus
Examiner Comments

This response also scores both marks.

(ii) A sperm travels a distance of 14 cm to fertilise an egg.

This sperm travels at a speed of 3.0 mm per minute.

Calculate the time taken for this sperm to travel to the egg.

Give your answer in minutes.

(2)

~~Speed = Distance / Time~~ ~~140 : 3~~

~~3 / Speed = 140 / Time~~ 14 cm = 140 mm

~~3 / 140 = Time~~ 140 : 3 = time

46.66... = time

47. = time

time = 47 minutes

ResultsPlus
Examiner Comments

This response also scores 2 marks.

ResultsPlus
Examiner Tip

Since the data is given to 2 significant figures. The answer can also be expressed to 2 significant figures.

Question 8 (a)

Q08a told students that fish gills have similar adaptations to alveoli. They were then asked to suggest how fish gills are adapted for gas exchange. Most responses gained credit with the best ones describing large surface area, thin walls and a rich blood supply to carry away oxygen and bring carbon dioxide to the gills.

8 (a) Fish do not have lungs. They use gills for gas exchange.

Fish gills have similar adaptations to the alveoli in lungs.

Suggest how fish gills are adapted for gas exchange.

(3)

Gills have one cell thickness for efficient diffusion.
Gills have a larger surface area for gas exchange.
Gills have a network of blood capillaries for gas exchange to take place.

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Examiner Comments

This response scores all 3 marks for one cell thick, large surface area and blood capillaries.

8 (a) Fish do not have lungs. They use gills for gas exchange.

Fish gills have similar adaptations to the alveoli in lungs.

Suggest how fish gills are adapted for gas exchange.

(3)

Fish gills have a large surface area that allows a much larger volume of gases to diffuse into and out of the cell. The walls of the gills are also moist as allowing the gases to dissolve making diffusion effecient. Furthermore the walls of gills are one cell thick, providing a shorter distance for diffusion to take place. There are blood capillaries found as well that can help maintain a steep-concentration gradient.

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Examiner Comments

This response also scores 3 marks. For large surface area, thin walls and blood capillaries.

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Examiner Tip

No credit for being moist as gills would be underwater.

Question 8 (b)

The last item on the paper, Q08b, provided students with information about how a person keeps fish, it also gave a graph of the changes in the oxygen level in the fish tank. Students were asked to evaluate his claim that he keeps his fish in good condition. The command word evaluate requires students to review information (e.g. data, methods) then bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. The responses to this longer item scored from 0 to 6 with only the best students scoring all 6 marks. The best responses included points for and against the claim and reaching a conclusion that he does not keep his fish in good condition.

The person claims he keeps his fish in good conditions.

Evaluate this claim.

(6)

The person is wrong. He doesn't keep the fish in good condition. This is because the concentration of oxygen goes very low at certain times. For example at 70 hours, closer to the third day, Oxygen concentration has gone down to 2.5, and at 90 hours, it has gone even lower than that. He feeds the fish too much food because sometimes it may not be eaten & this will be decomposed by bacteria. This process also uses oxygen up and releases carbon dioxide. He does not use the aerator for long enough each day. He should also change the water in the aquarium more often because he puts in too much food. However, he does one good thing. He keeps the aquarium close to the sunlight. This ensures that plants can photosynthesize and release oxygen. But during the night, they too respire and oxygen goes very low. So he must use the aerator more often. O_2 concentration continuously changes → bad.

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This response scores 6 marks. It refers to the negative points such as falling oxygen concentration (marking point 7), decomposotion of excess food by bacteria (marking point 10), reference to use of the aerator (marking point 2). It also mentions positive points such as allowing light for photosynthesis (marking point 1) to produce oxygen for respiration (marking point 3). He also states that the claim is wrong (marking point 11).

The person claims he keeps his fish in good conditions.

Evaluate this claim.

(6)

His fish cannot be claimed to be in good conditions as the conditions aren't helpful. The aerator is set only for one hour a day which is not healthy and it produces large bubbles of oxygen instead of small that may not be absorbed effectively by the fish for aerobic respiration. And he is feeding the fish several times a day in large quantities that may not be advised to do as this can be more than required and can produce a lot of faeces and also it can be seen that at the end of the day the oxygen levels in the water drops as the plants in the water and the fish respire aerobically, increasing the oxygen demand therefore an aerator should be used. However the fish tank is kept near a window that allows the plants to photosynthesise and produce oxygen when the aerator is switched off and also it is good that the water is replaced every four days that doesn't allow the excess faeces to be deposited and for bacteria to decompose it with the help of aerobic respiration that will increase the oxygen demand.

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This response also scores 6 marks. He disagrees with the claim (marking point 11). He also notes that the aearator provides oxygen (marking point 2) for respiration (marking point 3). He states that the oxygen levels fall (marking point 7). He refers to light for photosynthesis (marking point 1) and water replacement to remove faeces (marking point 4).

Paper Summary

Based on their performance on this paper, students are offered the following advice:

- ensure that you read the question carefully and include sufficient points to gain full credit
- in evaluate items include points for and against and make sure that you include as many points as there are marks available reach a conclusion that reflects the points you have made
- make sure you have practised calculations and understand and know how to apply any formulae
- write in detail and use correct and precise biological terminology
- make sure you have expressed your answer in the correct units and can convert between for example mm^3 and dm^3 and express large or small numbers in standard form
- remember to use the knowledge and skills acquired during practical work to help in questions about unfamiliar or novel practical procedures
- in experimental design items always be able to name the independent variable and give the range of values, the dependent, and how you are going to measure it and the control variables and explain how these will be controlled
- read through your responses and ensure that what you have written makes sense and answers the question fully

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