

Examiners' Report June 2023

International Advanced Level Biology WBI14 01



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June 2023

Publications Code WBI14_01_2306_ER

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Introduction

This paper was fairly typical of a WBI14_01 paper, covering a range of specification points from topics 5 and 6, with a few synoptic topics included as well. The questions used a variety of command words and including the statutory number of multiple choice questions and maths marks.

The multiple choice questions were quite well answered and the calculations performed better than in previous years. It was also evident that centres are more familiar of the requirements of the levels-based questions and are preparing their candidates for these more effectively. The two levels-based questions performed very similarly with almost identical mean marks.

Question 1 (a)

Most candidates were able to score at least 1 mark for stating that magnesium ions were part of a chlorophyll molecule. A reasonable number of these also gained the second mark for chlorophyll **absorbing** light. The second mark was often lost for failing to use the term 'absorb' and stating that it was either 'trapped' or 'captured' instead.

There were extremely few responses that mentioned other ways in which magnesium would be important, not surprisingly, as these are not covered by the expectations of the specification. They would have been awarded the marks if they were correct however. 1 A student investigated the uptake of magnesium ions by some plant cells in the presence and absence of oxygen.

The graph shows the results of this investigation.



(a) Explain the importance of magnesium ions to a plant.

(2)light absorption and (besis)



Helping with light absorption is slightly odd wording but this candidate clearly knows the importance of magnesium ions.

Question 1 (b)

Many candidates just described the graphs to score mark point 1.

Mark points 2, 3 and 4 were all seen but not necessarily in the same response, so the more able candidates would score three marks. Of the three, mark point 2 was the least frequently seen as candidates simply referred to active transport being involved, but we had told them that in the stem of the question. The last mark point was rarely awarded.

(b) The student suggested that magnesium ions are taken up by active transport.

Explain why the student came to this conclusion.

Use the information in the graph to support your answer.

(4)has higherrate with oxygen 1ons aptake exgygen . and graph without oxogen bamin while wit Oxegen continues 13 9 process Droomled bia in rootharcells ria orayon presence 1 O2 is used 11 Acro er up by d en presence or o (Total for Question 1 = 6 marks)



(b) The student suggested that magnesium ions are taken up by active transport.
Explain why the student came to this conclusion.
Use the information in the graph to support your answer.

O more magnesium ions taken up by the plants cell when oxygen presence

@ because plant absorb oxygen for Gerobic respiration in mitochondria

3 and mitochondria absorb exygen and release ATP

D so magnesium Tons taken up by the plant cells need ATP, ATP support active

(4)

transport from low concentration to high concentration



Question 2 (a)(i)

A high number of candidates scored 2 marks with many scoring at least 1 mark for calculating the mass. Sometimes the final correct answer was only awarded 1 mark as there was incorrect rounding or too many decimal places given.

2 The photograph shows a black bear.



(Source: Cindy Hopkins/Alamy Stock Photo)

Most black bears have a diet consisting of ants and berries, and hibernate during the winter months.

One very large male black bear, called Hank, was suspected of raiding nearly 40 homes in the Lake Tahoe region of America for food. Some of these raids took place during the winter months.

- (a) Hank weighed 227 kg, which is 1.7 times more than the mean mass of a typical large black bear and 5 times more than the mass of a typical small black bear.
 - (i) Calculate the difference in mass between a typical large black bear and a typical small black bear.

* typical large black bear: $\frac{127}{1.7} = 133.5469$ * typical small black bear: $\frac{227}{5} = 45.5469$ Difference: 133, 5= 115, 5= 88kg

Answer 682 kg



A clearly worked through calculation.



We strongly recommend that you show your working in calculations. It will help you spot any errors but more importantly, if you do make a mistake you may still pick up a mark.

Question 2 (a)(ii)

Candidates were generally able to score mark point 1 for reference to Hank's food being higher in energy or calories or fats etc, or the converse of this. Some candidates referred to the idea of Hank eating all year round or eating food in the winter while other bears were not.

There were less candidates scoring the second mark as many failed to recognise that Hank stored energy as fat or biomass, or that hibernating bears lost biomass, lost weight or lived off their reserves.

(ii) Explain why Hank was much larger than typical black bears.

(2)ad access to more mutrient dense fords an allers bear ~ months eat during Late more the winter his most long prevented so he





A number of candidates referred to the NPP of the bears; this is a term that we use for plants, not animals.

Question 2 (b)(ii)

Most responses referred to comparing band patterns, numbers, position or sizes or to DNA profiling, base sequencing, gel electrophoresis or genetic fingerprints etc, to gain mark point 1.

Very few candidates were able to state that bands which would only be found on females (ie, were specific to females) would be seen on two of the samples analysed, thus mark point 2 was rarely seen as few candidates recognised this or were able to clearly state it.

Similarly, for mark point 3 candidates needed to state that all of the bears would have different banding patterns or that there would be some differences in the patterns for all three bears.

Some candidates did not read the question carefully enough and referred to analysis of chromosomes.

(ii) Describe how analysis of the DNA would show that these two other bears were female, and not related to each other or to Hank. (3)profiling By DWA lae obtain bandling partiern electrophores is we china. G offe Aggements differen resulted OFGIN A female banding distance that Therefore & we can female beens banding pattern for the much similary therefore rebteel to Hank or





When describing the DNA fingerprint that results from gel electrophoresis, make sure you refer to the 'bands' and do not use terms like blocks or fragments.

Question 3 (a)

Many candidates scored the second marking point here for clearly distinguishing between bacteriostatic and bactericidal antibiotics. However, fewer candidates gained mark point 1 as we needed a clear, categorical statement that **both** targeted bacteria.

	pmhibit Pk	ill
3	3 Tetracycline is a bacteriostatic antibiotic and vancomycin is a bactericidal a	antibiotic.
	(a) Compare and contrast bacteriostatic antibiotics with bactericidal antib	iotics. (2)
t	bacteriostatic antibiotics inhibits the growth the bacteria stopping the bacteria from re	at eplicating,
l	Unereas Bactericidal Autibiotics destroys an	d wills
	backeria over time bath of these antibiotic	stap
	the growth at the bacieria.	



sentences with the comparative term 'whereas'.

- 3 Tetracycline is a bacteriostatic antibiotic and vancomycin is a bactericidal antibiotic.
 - (a) Compare and contrast bacteriostatic antibiotics with bactericidal antibiotics.

(2) Bacherio static inhibiotics inhibit the growth of backeria whereas backericidal antibiotics kill the are both used for meatment against to pt completely pathogenic



Question 3 (b)(i)

Reasonably well answered, with most candidates scoring mark point 2 for loading the antibiotics on to filter paper or the origin. Some candidates described a pencil line being drawn first and then spotting the antibiotic on the line, even though we had indicated the origin in the diagram. A good number of candidates also gained mark point 3 by stating that the filter paper was dipped into the solvent, but there were some who implied that the origin would be beneath the solvent.

There were fewer candidates scoring mark point 1 (antibiotic dissolved in solvent) or mark point 4; candidates were too vague and did not qualify how long the chromatogram was allowed to run. (b) Antibiotics can be identified using Rf values obtained from chromatography.

The table shows the Rf values for tetracycline and vancomycin, obtained using two different chromatography methods.

	Rf value				
Antibiotic	Method 1	Method 2			
Tetracycline	0.51	0.75			
Vancomycin	0.09	0.29			

The diagram shows a chromatogram for one of these antibiotics using one of the methods.



(i) Describe how this chromatogram could be produced.

(3)

Bravi a line on the chromatography paper and it is the origin. By a drop of the antibirtic solution onto the origin line. But the paper into the solvent, below the argin line. Take the paper out when solvert almost reaches the top of the paper, drav a line on it which is solvent front.



(b) Antibiotics can be identified using Rf values obtained from chromatography.

The table shows the Rf values for tetracycline and vancomycin, obtained using two different chromatography methods.

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The diagram shows a chromatogram for one of these antibiotics using one of the methods.



(i) Describe how this chromatogram could be produced.

- the antibistics would have been chushed and mixed with an
alcohol such al ethanol in their own separate bowls. this
passe would then be added onto an chomatography paper , again
as a dot against a marked line near one end. This end
would be trate to dipped and crocked in water, so that
it would toak the paper, puching the antibiotic parte upwards
as in spreads.

Another response gaining full marks but illustrating a different combination of the mark points.

(3)

Question 3 (b)(iii)

Candidates spotted the fact that different solvents were used and that there was a difference in the solubilities of the antibiotics. Few responses were specific enough to be awarded our third mark point.

(iii) Explain why the four values in the table are all different from each other.

method uses different solver different paper. Antibiotics have different solubilit ies solvent à différent affinity for différer moves differen travels (Total for Question 3 = 8 marks) This response illustrates three of our mark points, gaining full marks. Examiner Ti In a question like this, two differences need to be explained as the mark allocation is two. Always check the number of marks allocated to a question to help you work out how much you need to write.

(iii) Explain why the four values in the table are all different from each other.

(2)The two antibiotics have different solutilities in the solvent and affinity to the chromatogram paper. Same antivitie shows different Rf value in different methods as the solvent or stationary phase or mobile phase used is different and the antilistic has different force of attraction to the phases used.



Question 4 (b)

This item is effectively three multiple choice questions rolled into one. A range of responses were seen but candidates who did not read the question carefully frequently selected the wrong option for the 70S ribosomes.

Question 4 (c)(ii)

Many candidates were able to identify the source of the sample, usually naming the faeces or the intestines. Some incorrectly named the stomach. Many candidates referred to an appropriate method to determine numbers such as dilution plating, use of a colorimeter for colony counting, using a haemocytometer to determine numbers or measuring turbidity. A surprisingly high number of candidates wrote about having to culture the bacteria on agar before measuring the turbidity.

Fewer candidates gave an appropriate, corresponding detail of the method, although this point was usually gained for reference to aseptic technique.

Surprisingly few candidates referred to an appropriate method of identifying or eliminating bacteria, such as colour of colonies or indicator media. As well as this, very few candidates gave a description of how the relative abundance would be determined as candidates did not refer to the bacteria other than the Streptococcus.

(ii) Describe one method that could be used in this study to determine the relative abundance of Streptococcus in a giant panda.

(4)

Using bacterial culture nothed
Obtain bacteria From giant panda intestines
Culture bacteria en a trutient agar, incubete
For 24 hours of 20°C. storile
observe bachevia colonies and count the
number of stropto co cues colonies on the agar
plate.
listinguish streptococus from other backerin
through its size, shape and colour.
or use an agor plate that contains - ntibirties
that kill other bectoria except for fireplococous.
Streptococcus has to be (Total for Question 4 = 9 marks)
resistant to the antibiotic





Read the question carefully to make sure that you have actually answered it; you may be required to apply your knowledge to a particular scenario and so a generalised answer will be insufficient. mappie -> ginner planting -> fine biaity

	(4)
A sample can be obtained from either the giant panda	is gut or
from facus and can be fest for sheptocouns. I San	ples can
be taken from 5 pandas belonging to even group; cubs,	woung
adult and adults. The samples of bacteria would be	hard to
anaugre as colonies cannot be counted as bacteria	numbers
would be too large. So dilution plating can be carried	out 80
mat you can get a lever so of partens onto be	st tube
by drunning 1 cm3 of the sample with 9 cm3 of distilled	water. The
go of bauteria present can be obtained using a turbidity.	veter and
you can measure which bacteria are streptococcus by mi	voduang
a backmadal antibiotiz to which only streptococcus is real	itant to
and count the no of streptococcus remaining and multiply	butne narks)



Examiner Comments

The candidate who wrote this answer also took the approach of using antibiotics to eliminate the non-Streptococcus bacteria.

(ii) Describe one method that could be used in this study to determine the relative abundance of Streptococcus in a giant panda.

Take Extract a sample of faces, using a sterile vive loop. Then take a
Sterile nutrient agar plate, & Add the 0.1 cm3 of faces into the
nutrient agar plate and spread evenly using a sterile spreader. Then
close the dish with a lid and cross tape it. But it in an incubalar
at 25°c for 24 hours. Then the exceeded a binding dye that only
binds to streptororrus bacteria. Then count the number of colonies
that have been labelled.

Another good response but this candidate wrote about using a dye to identify the appropriate colonies.

Question 5 (a)(i)

Generally answered well by those candidates who used a tangent that touched the outside of the curve at 1200 seconds and then gave their answer to an appropriate number of decimal places. A reasonable number of candidates were able to do this, but some were limited to 2 marks as their final answer was given to more than 3 dps.

An error carried forward (ECF) was applied for 2 marks for those candidates who did not draw a tangent but realised that the line did not start at the origin. An ECF for 1 mark was allowed if a candidate used the value of 148 on the y-axis by tracing a line from the curve at 1200 and then dividing 148 by 1200.

5 (a) In an investigation, scientists attached a molecule called PBF to the cell surface of a species of green algae, C. pyrenoidosa.

These algae are photosynthetic organisms and PBF absorbs green light.

The scientists measured the production of oxygen by C. pyrenoidosa, C. pyrenoidosa with PBF attached and PBF only.



The graph shows the results of this investigation.

(i) Calculate the rate of production of oxygen at 1 200 seconds for C. pyrenoidosa with PBF attached.

(3)

$$\frac{175-70}{1600-0} = \frac{105}{1600} = 0.065625 \,\mathrm{nmol}\,\mathrm{secs}^{-1} \approx 0.0656$$

Answer	0.00	\$56
7 11 13 11 1	*************************	

nmol secs⁻¹



This candidate drew an accurate tangent but then did not select an appropriate number of decimal places to express their answer to.



One of the maths skills is selecting an appropriate number of decimal places to give your answer to. Do not just copy down the numbers on the calculator and move on to the next question. Check that we have not given you an instruction on how to express your answer and if we haven't, then you must decide that yourself to gain full marks. 5 (a) In an investigation, scientists attached a molecule called PBF to the cell surface of a species of green algae, *C. pyrenoidosa*.

These algae are photosynthetic organisms and PBF absorbs green light.

The scientists measured the production of oxygen by C. pyrenoidosa, C. pyrenoidosa with PBF attached and PBF only.



The graph shows the results of this investigation.

(i) Calculate the rate of production of oxygen at 1 200 seconds for *C. pyrenoidosa* with PBF attached.





This candidate used the origin to calculate their rate but as they did this correctly and expressed their answer to 3 dps, they could be awarded the 1 mark ECF.

Question 5 (a)(ii)

Many candidates were able to clearly state the effect of PBF on oxygen production for mark point 2 and some were able to give a reason for greater oxygen production for mark point 4, such as there being more light absorbed, or a greater range of wavelengths absorbed or simply stating that green light was also absorbed by the PBF in addition to the normal range absorbed. The mark was not awarded to candidates who repeated the stem of the question and simply said that PBF absorbs green light with no qualification. Fewer candidates referred to oxygen being produced by photolysis and hardly any responses stated that none or hardly any oxygen was produced by PBF as it was not photosynthetic.

(ii) Explain the effect PBF has on the production of oxygen. (3)PBF increases the production of oxygen of C. pyrenoidosa over C. pyrenoidosa alone or PBF alone. This is because PBF absorbs green light which the algoe is unable to absorb on its own (it reflects it it's a green algae) is able to ana energy from that light absorption to denate donate the the chloroplasts / thy falloid he algae so ot light-dependent sha electrons to become exicited phololusis (s water) to occur to replace the electrons enten electron carriers so more exygen is produced



(ii) Explain the effect PBF has on the production of oxygen.

PBF increases the production of oxygen. This is because the photosynthetic pigments in plants (chiorophyil) absorbs light at different Novelengths but doeint absorb green light (it reflects it, hence, it appears green) when @ PBF is attached, green light is also absorbed, therefore more light is absorbed for the excitation of electrons in the photosystems and the photosysis of Hoter. The photolysis of water produces oxygen, electrons and hydrogen protons. Therefore, the more light for photolysis, the more oxygen is produced.

The candidate who wrote this response has clearly thought carefully about what was being asked and has worked their way methodically through the answer.

Question 5 (b)

It was pleasing to see a number of good responses here with candidates demonstrating a good understanding of this topic.

To gain mark point 1 each of the options in the mark scheme were covered in the range of responses seen, with many candidates stating that more ATP was produced or there was a faster light dependent reaction or more reduced NADP produced. There were also some references to reduced NAD unfortunately.

Candidates also referred to more GALP or glucose produced in the light-independent reaction or the Calvin cycle, although few referred to carbon fixation.

A good number of candidates carried on to state that more organic molecules were produced, with some better responses naming an appropriate organic molecule such as starch, cellulose or protein, or by referring to increased NPP or biomass. (b) These scientists also measured the mass of C. pyrenoidosa, with and without PBF remains attached, after a 20-day period.

They found that the increase in mass of *C. pyrenoidosa* with PBF attached was greater than the increase in mass of *C. pyrenoidosa* without PBF attached.

Explain these findings.

(3)

when PBF w attached, it produces more of PBF w also used to trap light which is used to produce Ht and Of. The Ht ions

are used to produce ATP and NAPH during the light dependent

racn. Because the plant is trapping more light, more ATP and NAPH

is produced, which is then used during the light independent

increation after the carbon has be fixed by ribulose biphosphake

glycerate-3 phosphate is then reduced by the NAPH and Ht ions

with the help of ATP to produce GALP, which is then converted

to other products such as car bohydrates proteins, patty acids to some carbohydrates are converted to starch which us es stored and other products are (Total for Question 5 = 9 marks) Used to help it grow. Because there is more GALP produced when PBF is used, the mass is more and that is why those results were round.

This candidate has pretty much written everything they know but they have included our three mark points in their account. The reference to NAPH is clearly not correct but we did not feel that it was enough to negate mark point 1 which we could award for the reference to 'more ATP'.



Although you will not lose marks for writing too much, you could end up spending too much time on one response and then run out of time at the end of the paper.

Question 6 (a)

There were some good definitions given.

However, in a fair number of cases, candidates referred to the body rather than tissues or cells thus failing to get the mark.

6 Malaria is a life-threatening disease caused by the pathogen *Plasmodium*.

Plasmodium is transmitted into the blood plasma of a person through the bite of an infected mosquito.

The Plasmodium is a sporozoite that travels to the liver cells.

This sporozoite produces merozoites that infect red blood cells.

(a) State the meaning of the term infection.

(1)





This candidate clearly knew the definition of infection.



Make sure you can write accurate definitions for any of the terms used in the specification, as you can be asked to state the meaning of any of them on the papers.

Question 6 (c)(i)

Candidates who had carefully read the information provided at the beginning of Q06 and used it in order to formulate a response fared better here.

The best responses recognised that the immune system was triggered by the *Plasmodium* sporozoites in the vaccine, which would generate memory cells. This would allow a secondary immune response which would destroy the sporozoites.

There were some good responses gaining 2 marks, but very few candidates scored three marks as they either did not say anything about accessibility for mark point 1 or were unable to finish by stating that liver cells were protected from the sporozoites.

(c) Scientists are trying to develop vaccines to protect against malaria.

One vaccine uses living sporozoites.

(i) Suggest why sporozoites are used in a vaccine against malaria.

(3) by phagocylosis weakened Sporcozoites are engulfed by macrophages and digested, Macrophage here procent APC to forms APC and presents antigen to T-helper cells that lead to the formation of B-memory cells that tremain It in the blood and produced antibody when the spokozoites' antigen is detected in the blood. Antigens Antibodies complet complementary to the antigen of sparazoites will be produced. Sparazoites will be agglutinated and engulfed by macrophages so they cannot travel to liver cells and procluce merozoiter. 50 red blood Cells will not be grifected. Artificial active formunity is achieved.



This is an example of one of the better responses that we saw.



In a question where the context is unfamiliar, identify which part of the specification you are being tested on and then apply what you have learnt to the question. The clue here was vaccine.

Question 6 (c)(ii)

Our first and fourth mark points were the ones most frequently awarded. The second and third mark points were rarely awarded, as candidates did not pick up on the role of the two different chemicals.

 (ii) In clinical trials of this vaccine, people were injected with the vaccine and two chemicals.

One chemical kills sporozoites and the other kills merozoites.

Deduce why these two chemicals were injected with the vaccine in these clinical trials.

(3) In case the vaccine was unsuccesfull in thiring all against the sporazites, the chemical that kills the sporazites making antibodies all against A the sporazites, the chemical that kills the sporazites making antibodies all against A The sporazites, the chemical that kills the sporazites making antibodies all against A The sporazites, the chemical that kills merozites mould merozites the chemical that kills merozites mould get rid of them This ensures that the people in the trial did not become infected by Plasmadium to develop Malaria.



We rarely saw all our mark points in one response. This response is one of the exceptions.



Make sure that you read all the information given and that you use it in your answer; the information is there for a purpose. The second sentence in the stem of this question states 'One chemical kills sporozoites and the other kills merozoites'. You are then asked to write about the inclusion of the two chemicals in the trials. As each chemical has a different target then each chemical must have been included for a different reason. Therefore each chemical needs discussing separately.

Question 6 (c)(iii)

Candidates recognised that they had to write about a secondary immune response so picked up mark points 2 and 3 but did not write about the ultimate destruction of the sporozoites. A disappointing number of candidates realised that the two strains must share some common antigens. There were a significant number of responses that did not even mention antigens at all.

(iii) Later in the clinical trials, people were infected with one of two strains of sporozoites, three months after the vaccination.

One strain was identical to the one used in the original vaccine and the other strain was a different one.

The trials found that the vaccine was effective against both strains.

Exp	lain	t	nese	find	ings.	
-----	------	---	------	------	-------	--

cel	ls sp	ecific	to it,	50	21 +1	erad	icated	ımm	ediate ly	
т	a seco	ndau	1 ummu	ne	respo	nse.	,,,,		*******	
Alt	hough	, the	other	str	ain	is dif	Ferent	, bol	th are	
.po	rozoita	es an	d 50	have	, at	least	one	comm	on surta	ce
pro	tein,	whio	n ks r	ecog	niced	by P	he imi	mune	system	
	Inell	Anh	hodies	of	Grist	strain	will	also	atlack	



This was a good response. Although it does not mention antigens, it is clearly describing them so could be awarded mark point 1.



The word 'antigen' is a specific term used in immunology. If a question is clearly testing you on this part of the specification, you are more than likely going to be required to refer to antigens in your answer.

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(iii) Later in the clinical trials, people were infected with one of two strains of sporozoites, three months after the vaccination.

One strain was identical to the one used in the original vaccine and the other strain was a different one.

The trials found that the vaccine was effective against both strains.

Explain these findings.

		s		Q 0	(3)
The two different strain	ns me	in that	the	epore	zoites
have mutated to giv	ear	new str	ain. I	Howeve	
as been vaccine has	been	effect	ve c	agains	t both
strains, the strains	may '	have a	x slm	<i>silar</i>	antigen
to original strain, so	that no	nemory	celle	, in t	he
body can identify	it, and	effe	ctivey	des e	liminate
it during secondary	mmune	respe	nse.		



This candidate clearly recognised what this question was asking. The explanation about mutations was not necessary but did not detract from the answer required.

Question 7 (a)(i)

Very well answered by a majority of candidates doing the calculation correctly. Ordinary years and leap years were allowed for, resulting in six acceptable answers in the scheme with appropriate roundings.

Question 7 (a)(ii)

Candidates were generally aware of the importance of nitrates to plants and the majority scored at least one mark. We did expect more description than WBI12 might look for, as this is an A level paper even though the question was synoptic with an AS paper. Few candidates used the mark allocation to describe two uses.

Nitrates contain nitrogen. Describe the importance of nitrates to plants. (2)produces annino acids that can will turn into protein and entrymes the like RUBISCO -is essential t in calvin cycle to I it catalyses the coversion of carbon dioxide GF it also allow growth and repair of



Those candidates who did get awarded both marks tended to get mark points 1 and 2, as illustrated in this response. Although we did not expect a named enzyme and chemical reaction to award the second mark it was good to see it.



Use the mark allocation to help you decide how much to write. It is unlikely that in a question like this, you will get two marks for one importance.

Question 7 (b)(i)

This was a fairly straightforward calculation that the majority of candidates evaluated correctly.

Question 7 (b)(ii)

Some candidates still do not appreciate how a value should be expressed in standard form, losing this mark as a result. There should be only one digit to the left of the decimal place. An appropriate number of decimal places is still required in a standard form format.

Question 7 (b)(iii)

The full range of marks was seen here in this level-based question, with a fairly good number of candidates achieving Level 3. There were a number of different aspects that could be discussed so candidates who limited their discussion to a single aspect would only achieve a low Level 2 mark. A broader discussion opened up access to a higher-level mark.

This question asked candidates to use the information to discuss the effect of an increase in whales on climate change, which depends on the amount of CO_2 and other greenhouse gases in the atmosphere.

The organisms in the diagram are all inter-related and so the best strategy would be to take each of the organisms in turn, phytoplankton, other organisms like zooplankton and fish as well as whales and discuss their effect on removal or release of CO_2 to the atmosphere.

Many candidates were able to discuss the effect of nutrient release from whales at the ocean surface on the number of phytoplankton and the consequent removal of CO_2 from the air by photosynthesis and relate this to reducing global warming and why.

Some also referred to the increase in zooplankton and fish and consequently whales, but discussion here was usually not so good, with the increased release of CO₂ due to an increase in respiration rarely considered.

There were a small number of really good responses which wrote about whales as 'carbon sinks' and of whales dying and CO_2 being released very slowly due to unfavourable conditions, thus trapping carbon deep in the ocean and how this would help reduce global warming.

Few candidates actually referred to the decomposition of the other animals with decomposers releasing CO_2 to the air by respiring and so increasing global warming.

*(iii) Discuss the possible effects of increasing the number of whales on climate change.

Use the information in the diagram and the data given in this question to support your answer.

(6) Increasingthe number of whales would increase the amount of nitrogen and other nutrienter released into water and water surface, so increase nutrients allow tor more growth of phytoplankton which means higher rates of photo synthe somere CO2 is uptaken and O2 released so less CO2 present in atmosphere Du less greenhause gasses present in atmosphere, resulting in less reabsurption IR rudiation and loss reliection back to surface so causing reduced increase in global tempieratives so reduction in climate change. Increase in phytoplankton increases beeding of both Zooplankton and hence dish and other animals as increased abundance results in increased keeling hence lager populations so longer population causes an increase in the mespiration nates which release CO2 into ocean and atmosphere thus increasing greenhouse gusses and can increase absorption and reflection of IR radiation but to each surface causing increase in global tomp, which can increase evapuation of acean water thus increasing humidity levels ites and release more (Oz as ocean is a carbon sint. More hales also causegoure wholes at bottom of ocean which are decomposed by bacherizig ud archer which use nutrients from whe leto respite and release (Oz and positing methane causing same events as previous bur animal vespiration. But projections show that removal of (0, by (Total for Question 7 = 11 marks) phytoplankton is greater than COr release as 1.7x10° tonsof CO2 could be renoved how almosphere which could reduce climate change us stated before -homprenions question



This is a particularly good response. The aspects covered are extensive, consideration is given to how the whales could result in an increase or decrease in climate change, the approach is logical and the argument clear and information in different parts of the question have been discussed.



Read the question carefully as there will often be instructions on what you should be including in your responses.

*(iii) Discuss the possible effects of increasing the number of whales on climate change. Use the information in the diagram and the data given in this question to support your answer. (6) increasing the surper of ubales will reduce global marring, and so reducting limate change this is because inclusing the number of shales with in crease 14 alose of notionts is to the water is their faults which they care 12 elles al so is resing the intaut uptalse seekel by sugare of to play they su Incressing the cate of Thetisy atterise of phy for p/ lo 15 k icrain the Nfy of the phyte play 13 tos alo t to uside Allen weryy transfer from the phylaplastic to the Tex plasts to and vente feet in 200 phatston, incresing 12 rate of and internals More fish playingtesse if the plays plants to cerults is an incress is up told of carbon dioxide uside is a greshing ges that leads to gla but warming absults long vave cadiation pasing an increse (Inate things as it tangentre so las lixide is alsed in atomsphere lo bas 5 whill include, ad so use He date direty bing up outrich \$ The surface 51 He phylephilites to tomase gow, incrusing outriest up talse pre alla in (wing My tiff, cate of protoryo Besix of plast and so more plants will photom theise at in the lactor di tide relad fra the pication and Fills and minal feeding on the Two places to a cells Lou plas Bton Allong orities of Whale siding in the bottom the later diexide cloud (Spilation of minus and flo mpis VS is lefe (and (Total for Question 7 = 11 marks) Mayude f us accour in light larbon divyid is cuttis; whin ryde. 1.5 x10 12 Mg of low m be atralfors the environest. whals Sin Hing to bottion provide annerobic conditions to less der yours whale , have tess release of netbane which is a grachies Oliongise the the dos suless incluse in temperature.



This response is similar to the previous one with the discussion starting with the whales and then considering each organism in the diagram in sequence and then supporting the argument with some of the data from the earlier parts of the question.

Question 8 (a)

Many candidates realised the importance of keeping existing forests since trees are carbon sinks and remove lots of CO_2 from the atmosphere. Some really good responses referred to the slower removal of CO_2 by newer trees. Others also referred to destruction of trees by burning and subsequently causing release of lots of CO_2 .

There were many candidates that referred to established forests being homes or providing habitats for other species, but very few responses referred to established or native trees being more resistant to storms, drought etc.

8 Reforestation is an example of effective management of conflicts between human needs and conservation.

Organisations have put together a list of rules for responsible reforestation. These rules aim to improve absorbing and storing atmospheric carbon dioxide, biodiversity and human livelihoods.

Four of the rules are:

- 1. Protect existing forests first
- 2. Work together with local people
- 3. Select appropriate areas for reforestation
- 4. Select species to maximise biodiversity.
- (a) Explain the importance of protecting existing forests first (rule 1).

Existing forests are places of high biodiversity with many different plants and animals along with their natural habitat. Forests also act as carbon sinks and absorbs Co2 gas from the atmosphere. Without these forests, animals and plants a can become entired and even cause climate change.

(2)

This response is typical of many others that we saw for this particular question.

Question 8 (b)

This was well answered in general with many candidates scoring at least one mark and a good number scoring both marks.

Candidates were generally aware of the idea that locals would have a better understanding of the area they lived in (mark point 3).

Many candidates also showed an awareness that the livelihoods of the locals needed safeguarding (mark point 1).

In various ways many candidates also indicated that there was a need for the local people to understand the issues of global warming and the importance of the forests (mark point 2).

(2)As local people and farmers understand the nature of land and nutrients needed, as well as conditions for growth. In addition, working with local people is important them from cutting prest trees and to encourage to prevent Brests safe, provide them with Keel supplements



⁽b) Suggest why it is important that organisations involved in reforestation work with the local people (rule 2).

Question 8 (c)

One area that responses tended to focus on was that the conditions of the original forest would be appropriate for reforestation and many candidates gave examples of soil type, nutrient levels or temperature. A good number continued to explain that reforestation would be faster because of this. Unfortunately, there were quite a few candidates who spoiled their answer by writing this in the context of succession.

The other area many candidates focused on was avoiding destroying farmland or homes of local people by planting trees, although less came up with an appropriate explanation to support this assertion, such as causing resentment or loss of income.

Fewer responses covered the idea of avoiding destroying or disturbing or competing with other ecosystems but were able to refer to affecting other species or referring to avoiding a loss of biodiversity. Fewer still referred to joining together fragments of remaining forests and increasing genetic diversity.

In a number of cases, some reasons were given, without explanations, which would limit candidates to 3 marks.

(c) Explain **two** reasons why previously forested areas should be selected for reforestation instead of other wild areas (rule 3).

(4)

Aneviously forested area would already have optimum eenditions for reforestation
so trees will grow bater and more effectively. As a result, the previous biadives
biodimensity will also be nestoned
Oke, it presidently Ponesters are chosen selected to
Also, solecting other wild areas would en interrupt the habitets of living organizations.
there shill would have a negative imped on biodiversity so, it is a weller to
select previously forested ones.

Results Plus

This candidate clearly understood the question and how their answer should be structured to access full marks.

This is a really good example of where reading the question carefully and looking at the mark allocation will guide you on what is expected in your answer. We have asked for two reasons and an explanation for each with four marks available.

Question 8 (d)

Many candidates scored the overall mark here quite easily, which was to increase biodiversity (mark point 1).

The other mark points required clarification as to which type of species the responses were referring to ie native, endangered or genetically-diverse. Some candidates stated the species types they were discussing but others did not, thus limiting the quality of their response and the mark.

A reasonable proportion of candidates referred to native species being adapted to the existing conditions (mark point 2), but fewer suggested that these native species would support the existing wild life of the area (mark point 3), and very few candidates were able to refer to avoidance of the risk of non-native species outcompeting the existing native species.

Many candidates explained that introducing endangered species would help to avoid their extinction, but few referred to avoiding inbreeding or a drop in genetic diversity. Very few candidates referred to an increase in gene flow or an increased biodiversity within that species.

A reasonable number of responses included the idea that introducing genetically-diverse species expanded the gene pool, with a few excellent responses suggesting the idea of more alleles being introduced. Some very good answers included reference to increased biodiversity within that species.

The full range of marks were seen, with a good number of candidates able to achieve two or three marks.

(d) Explain why a mixture of native species, including endangered and genetically diverse species, should be introduced (rule 4).

Notive species introduced to ensure the ecosystem of the surrounding area is
not disrupted from invasive species
Endangered specres is introduced to increase the population of that specres
· to avoid extinction
· Genetically cliverse species to ensure allele frequency is large a large
, These The most me gene pool & allele frequency
All The mostive of species is used to increase the brodiversity of the
forest

This is an example of one of the better responses. This candidate did not expand on the importance of avoiding non-native species sufficiently to score the full four marks.



When a question lists more than one component, then each one needs to be dealt with individually and it needs to be clear which component is being referred to. The question lists a mixture of native, endangered and genetically-diverse. A comprehensive answer should address native and endangered and genetically-diverse together with the importance of a mixture.

(4)

(d) Explain why a mixture of native species, including endangered and genetically diverse species, should be introduced (rule 4).

Firstly so that biodiversity is high secondly to save endangered species to prevent them from extinction. And lastly, because native species are already adapted to the climate conditions of that are so they should survive

(4)



Question 9 (a)(i)

Most candidates were able to state that the core, rectal or liver temperature had to be found for mark point 1.

Far fewer candidates referred to the graph and if they did then they did not word their answer accurately, stating that the graph could be used to find the time of death when it should be time after death.

Very few responses then added that you worked backwards to find the time of death or that you subtracted the time found from the graph from the time of finding the corpse in order to establish the time of death (mark point 3).

- 9 The time of death of a mammal can be estimated in a number of ways.
 - (a) Measuring the body temperature of a corpse is one method used to estimate the time of death.



The graph shows a calibration curve that can be used in this method.

(i) Describe how the time of death of a person can be estimated using this method.

(3)

1. 2. 4

- A person's body temperature after being found is measured through the rectum for accurate measurement. The moresult is then marked on the graph and the corresponding time after death is obtained. Then using this time, the time of death is

calculated by subtracting it from the time the body was found.



Question 9 (a)(ii)

Candidates knew this part of the specification very well and we saw some very good responses. The less able candidates listed more than one factor but did not go on to explain how any of the factors affected heat loss.

(ii) Explain the limitations of this method.

The remperature of the surroundings environment and the
presence and thickness of clothing are all important favors
that hered to be considered. The thicker the upthing, the less the
decrease in temperature



(2)

Question 9 (b)(i)

The vast majority of candidates scored the mark here, with the usual reason being that it was more ethical to use rats or pig corpses, or it was less ethical to use human corpses. In a small number of cases, candidates mentioned that relatives might not agree to the human corpse being used or that the dead person could not give permission after death.

The idea of humans being genetically-diverse was not seen.

Question 9 (b)(ii)

In this, the second of the level-based questions, candidates were provided with graphs containing information on the usefulness of four different chemicals for determining the time of death of rats and pigs. They were to use this information to comment on the usefulness of these chemical tests.

Candidates who limited their discussion to descriptions of the data were limited to Level 1. If they commented appropriately on the usefulness of the data, but the comments were limited to one or two of the chemicals, they could achieve Level 2. To reach Level 3 required more of the chemicals to be discussed but also using the data more precisely. General comments about the usefulness of the data, such as the small sample size, some tests being species specific or an overall comment on pigs being more useful than rats, were taken into account as well.

The best way to tackle this discussion in an orderly fashion is to discuss the usefulness of each of the four chemicals in turn with regard to both pigs and rats individually and finally to make general comments about the usefulness of the data for both pigs and rats.

The full range of marks was seen with a minority of candidates confined to Level 1, a sizeable majority in Level 2 and again we saw a pleasing number of candidates gaining Level 3 with their responses.

Comment on the usefulness of using these chemicals for determining the time of death of rats and pigs.

Use the information in the graphs to support your answer. (6) The pH of blood after death decreases as shown by the graph. Initially there seems to be a negative trend which is a negative correlation because as science the house gop on the pH levels decrease. The standard denation pars overlap in most of the results meaning there is larger spread around the mean. This reduces the reliability of the data. This means an approximate time of dearn can be calculated but its not accurate enough to provide and specific hours. For sevels of ammonia the range bar is much smaller meaning the data is more valid. For rats it may not be as effective as the levels of ammonia dont charge too much, Authermore they increase then decrease meaning this method may only be effective for 9 hours - For pigs its probably one wear after 9 hours as the levels of ammonia increase from to above 12 so its easier toletermine time of death. Hypomume for rats increases then decreases after 32 hours. This means its effective while then but the Ashows could be mistaken for 9 hours. The bars also overlap decreaning calidry. For pigs it pucates ana the mend seems to be positive however its not rehable. Laetate in blood seems to be the worst method as there is barely any mends and the bar overlap is significant making it almost impossible after 6 hours

to determine

me levels

28

5×



This candidate has looked at the data for each chemical and discussed the rat and pig data separately. They have also read some values from the graphs so that they can say more specifically when a chemical can be used or not.



The trick to scoring well in a levels-based question is to cover all aspects of the question, having identified the command word.

There are four graphs with two sets of data for each. That would suggest a total of eight comments would be a good starting point. The command word is comment on, not describe, so you need to do more than say what the graphs are showing. The question expects the comments to be on usefulness so this must be what your answer focusses on.

Question 9 (b)(iii)

Disappointingly, a high proportion of answers to this question answered the previous question, with more candidates picking up on the word 'useful'.

Most responses tended to concentrate on the fact that some chemicals had similar patterns and so could be useful in humans (mark point 1) and some gave examples such as pH decreasing in both species. However, there were fewer of these than expected. Very few candidates referred to some patterns being species-specific and so not useful (mark point 2) and we rarely saw suggestions that the testing would need to be done on humans (mark point 3). A number of responses were seen saying that the chemical tests would need to be used in conjunction with other methods (mark point 5), but there were very few comments about sample size or the size of error bars (mark point 4); this was surprising as the sample size was so low.

(iii) Discuss whether these chemical tests are likely to be useful in determining the time of death of a human.

(3)man have may no nina of minas and cheni ON een in the experi Kat PICI numan No



(iii) Discuss whether these chemical tests are likely to be useful in determining the time of death of a human.

(3) raf and pigs are manals milar Some times con tea be Houever, humans have event tabolism reach's. unic cold mon be different pigs one pennent the the dor chol orde KNOW the mest The OF chemicals henon 01



Paper Summary

Based on their performance on this paper, candidates should:

- Read the whole question carefully, including the introduction, to help relate your answer to the context asked. Quite often, early parts of the question will be designed to give clues to latter components which might appear more obscure due to an unfamiliar context.
- Use all of the information provided in the question to help you with your answer, eg graphs and tables of data including the labelling; this is particularly important in the levels-based questions.
- Make sure when asked to explain your answer that you have effectively included terms such as because, so, therefore, as a result, in your response. Make sure that you do not simply describe the data or repeat the information in the question that we have given you.
- Set out calculations carefully, showing each stage of your working in case a mistake is made at the final step, and check that the magnitude of the answer and the units makes sense in the context of the question and consider how you should express your answer if we have not given you instructions on how to do so.
- Be specific in your vocabulary, avoiding vague terms such as amount and use something measurable such as volume or mass. Avoid using the term reproducible and refer to significance or valid, whichever is more appropriate.
- Attempt all questions and avoid leaving blanks, as blank answers are guaranteed zero marks.
- Look at appendix 6 and 7 of the specification to familiarise yourself with the command words and the examples of the mathematical calculations you are expected to be able to perform.

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