

Cambridge International AS Level

ENVIRONMENTAL MANAGEMENT**8291/21**

Paper 2 Management in Context

May/June 2026**MARK SCHEME**Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **28** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	<u>'List rule' guidance</u> For questions that require <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should not be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first <i>n</i> responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
BOD	benefit of the doubt given
TV	response is too vague or there is insufficient detail in response
ECF	error carried forward applied
	information missing or insufficient for credit
I	incorrect or insufficient point ignored while marking the rest of the response
R	incorrect point or mark not awarded
LNK	two statements are linked
SEEN	point has been noted, but no credit has been given or blank page seen

Annotation	Meaning
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
	blank page
	Assessment Objective (AO), number corresponds to AO1, AO2 etc.
	Level of Response. Number indicates the level awarded to the response (mark scheme details mark ranges for each level)
	correct awarding one mark from marking point or marking group 1. similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc.
	response has not answered question
	contradiction in response, mark not awarded
	Repetition in response

Mark Scheme Abbreviations

Abbreviation	Meaning
;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ecf	error carried forward
AVP	any valid point
ora	or reverse argument
AW	alternative wording
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
()	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks that can be given
M1, M2....	marking point reference

general guidance: in general ignore the following if unqualified:

pollution
land pollution
death
harms or damages or impacts health
harms or damages or impacts the environment
not environmentally friendly
affects or impacts environment / people
standard of living
resources unqualified

accept alternate wording throughout

allow development where stated

underlined terms are specially required for the marking point, although accept phonetic spellings throughout

guidance allow are extra marking points unless referenced to numbered marking point e.g. M1 or qualified e.g. **accept** CH₄ for methane

allow CO₂ CO² Co₂ co₂

allow the names or formula unless stated otherwise in additional guidance – however, incorrect formula will CON a correct name – however, this will be referenced in the additional guidance

allow GHG / GG for greenhouse gases

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Question	Answer	Marks	Guidance
1(a)	can (naturally) replenish;	1	ignore remade / can be used over again / reusable / reused / recycled / sustainable / replaced ignore stated time frames ignore does not use fossil fuels CON for naming a non-renewable resource, e.g. fossil fuels accept not finite / can be used infinitely / will not run out / can be regenerated / does not have a limit on usage / will not deplete / made quicker than is used
1(b)	M1 renewable resources; M2 not carbon based / reduces reliance on fossil fuels; M3 do not emit carbon dioxide or greenhouse gases;	3	ignore does not pollute / clean or green energy ignore carbon neutral guidance: accept answers based on wind or solar only M1 CON non-renewable resource M1 accept does not use non-renewable resources / not finite M2 CON for references to nuclear being carbon based or a fossil fuel M2 accept uses less carbon (based) energy / uses less stated example of fossil fuel, e.g. coal / does not use fossil fuels M3 ignore does not emit methane M3 ignore climate change / global warming M3 accept does not emit or release carbon (emissions) / less carbon dioxide emitted / no overall carbon dioxide emitted / does not emit GHG M3 accept idea of lower emissions of carbon dioxide

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Question	Answer	Marks	Guidance
1(c)	reliable and (sustainably) available and affordable (energy);	1	accept uninterrupted / continuous / constant / long term supply / at all times / not running out for reliable accept accessible / abundant / plentiful / enough, for available
1(d)(i)	M1 (2015) 30 and (2022) 215; M2 617;	2	M1 guidance : dates given for context M1 ignore values marked on axis M1 accept 30 and 215 seen in an incorrect calculation M1 accept 6.17 / 6.167 M1 accept 86(.04565) for max [1] M2 ecf on their M1 values provided correct method used, i.e. (2022 value – 2015 value) ÷ 2015 value × 100 M2 accept 616.667 or correct rounding, e.g. 616.7 / 616.67 M2 correct answer [2] (no working is needed)
1(d)(ii)	M1 correct plotting at 230 GW; M2 bar of equal width of other bars 3 small squares and space between 2022 and 2023 2 small squares and drawn with straight lines;	2	ignore shading M1 guidance $\pm \frac{1}{2}$ small square M2 guidance independent marks so incorrect plotting can get M2

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Question	Answer	Marks	Guidance
1(e)(i)	<i>any three from:</i> M1 <i>wind</i>: China, generates less from wind (than rest of world); M2 <i>solar</i>: China generates more from solar (than rest of world); M3 <i>wind and solar comparison</i>: China uses more wind than solar / rest of world uses more wind than solar / wind greater than solar for China and rest of world / China generates less from both wind and solar (than rest of world); M4 <i>manipulated comparative data</i>, e.g. rest of world is 166 GW more wind than China / China is 22 GW more solar than rest of world / rest of world is 1.5 times more than China for wind / total wind = 786 GW and total solar = 434 GW / China is 39% of rest of world for wind / China is 52% or 53% of rest of world for solar;	3	ignore explanations ignore windy ignore sunny or sun unqualified or sunlight accept energy (generated) from sun to mean solar accept alternate wording for generates, e.g. uses / produces M1 and M2 ORA rest of world M1 accept China has less wind (resources than rest of world) M1 accept for wind, China is < rest of world M2 accept China has more solar (resources than rest of world) M2 accept for solar, China is > rest of world M3 accept more wind generated than solar / ORA M4 ignore reading charts with no manipulations, e.g. wind for China is 310 GW and rest of world is 476 GW M4 guidance: data must be manipulated in some way (not just reading off charts) M4 guidance units needed M4 guidance manipulated comparative data gets [2] marks, e.g.: M1M4 for wind, rest of world = $1.5 \times$ China M1M4 for wind, rest of world = 166 GW more than China M2M4 for solar, China = $1.1 \times$ rest of world M2M4 for solar, China = 22 GW more than rest of world

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Question	Answer	Marks	Guidance
1(e)(i)			M3M4 China = 538 GW and rest of world = 682 GW from both resources or for both solar and wind M3M4 rest of world = 144 GW more than China for both resources M3M4 rest of world = $1.27 \times$ total for China M3M4 China = 82 GW more for wind than solar
1(e)(ii)	<i>any two from:</i> M1 wind speed or wind duration, too high or too low; M2 breakdown of equipment; M3 unreliable or incorrect data or variables; M4 natural disasters or stated example of natural disaster, e.g. extreme weather / flooding / typhoon / storms; M5 other disruption of production or stated reason for disruption of production, e.g. conflict;	2	ignore cost ignore overestimation / it is only a prediction / only an estimate M1 accept weather not suitable / wrong wind direction / change in wind pattern / less wind(y) / wind (speeds) unpredictable / wind or weather not reliable M2 ignore power loss / electrical production M2 accept damage to (wind) turbines / less turbines / less wind farms M3 accept inaccurate, data or variables M4 ignore climate change / global warming M5 accept political issues / war / lack of funding or low budget / technological improvements / lack of approval (from governments for turbines) / idea of prioritising fossil fuels
1(f)(i)	13;	1	accept thirteen
1(f)(ii)	M1 $10 \div 30 \times 100$ or 33.33; M2 33;	2	M1 accept 33.3 / 33.333333 M2 correct answer 33 gets [2] marks M2 ecf accept any answer to 2 sig. figs. providing working out shown

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Question	Answer	Marks	Guidance
1(f)(iii)	M1 <i>max one benefit</i>: less chance of public objection; encourages economic development in location ; available land for stated benefit, e.g. land for more turbines; stated low impact on people, e.g. few people to be impacted by visual pollution; job opportunities; M2 <i>max one limitation</i>: infrastructure required; limited road access for repairs; habitat destroyed or deforestation in this location; not enough workers; limited access for maintenance;	2	guidance: accept benefit or limitation written in either response line provided it is clear that something is a benefit or limitation ignore comments not related to population density, e.g. bird strikes ignore cost unqualified ignore storage of energy unqualified ignore isolated area ignore idea of providing more energy / access to energy / energy security M1 ignore benefits of renewables / low population density M1 ignore unqualified, more space / less people / availability of land M1 accept idea of most favourable weather conditions M2 accept cost of, transmitting / transporting / building infrastructure / cables / travel cost for workforce M2 accept efficiency decreases with distance transmitted / energy losses over a distance

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Question	Answer	Marks	Guidance
2(a)	<i>any three from:</i> M1 limits amount of natural gas available / natural gas is, a fossil fuel or non-renewable; M2 high temperatures or pressure or production of other chemicals requires energy; M3 reference to increased, global warming / climate change / greenhouse gas emissions; M4 cost of additional chemicals to obtain final product;	3	answers must relate to production ignore negative impacts of use of fertilisers ignore cost unqualified ignore water pollution / run off / pollution / air or soil pollution ignore pollution from additional chemicals M1 accept methane or CH₄ to mean natural gas M1 accept natural gas is a limited resource M3 accept increased emissions of carbon dioxide / increased carbon emissions / GHG emissions M4 accept cost of energy (for production)
2(b)(i)	<i>any one from:</i> M1 no or low waste; M2 little additional processing; M3 no additional chemicals required; M4 quick processing time;	1	ignore easier to, make / use / spread / apply ignore references to soil ignore good balance of product / not a lot of rock needed ignore less risk of, over-use of fertiliser or pollution ignore fertiliser not too concentrated ignore cost

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Question	Answer	Marks	Guidance
2(b)(ii)	M1 sectors in pie in rank order largest first beginning at noon and proceeding <u>clockwise</u>; M2 correct plotting $\pm 4^\circ$ M3 sectors match key;	3	guidance: use the protractor tool on RM guidance: annotate vertically M1 guidance: rank order: sulfur, calcium, other, potassium, magnesium M2 plotting guidance angles: check sulfur AND magnesium sectors using the protractor tool (48%) sulfur: $169 - 177^\circ$ (6%) magnesium: $18 - 26^\circ$ check calcium, others and potassium are approx. equal by eye – there is no requirement to check the angles for these three sectors M2 guidance plot lines must touch edge of circle and meet in at central point and sectors drawn with straight lines M3 guidance (1): rank order is not needed in the key – we are looking for the sector shading to match the key boxes. If the plotting is incorrect, we then look at the proportions (see M3 guidance 2). M3 guidance (2): plotting incorrect but sectors in correct proportions, e.g. sulfur > calcium > other > potassium > magnesium by eye (we accept calcium, other and potassium approx. equal), and key shading matches sectors = M3
2(c)(i)	no fertiliser (added);	1	ignore nothing / normal conditions ignore soil / water CON different fertiliser CON reference to changing a variable, e.g. different volume of water accept only water added (instead of fertiliser) / no treatment / inert substance

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Question	Answer	Marks	Guidance
2(c)(ii)	<i>any one from:</i> M1 idea of a controlled environment or stated controlled environment, e.g. controlled, temperature / water; M2 reduces negative impact of (extreme) weather; M3 no pests or no named pest; M4 idea of ease of monitoring or caring for the plants;	1	M1 ignore everything is the same / no differences M1 R keep control constant M1 accept no limiting factors / no external or confounding variables / identical (growing) conditions / same conditions / controls variables / no extraneous variables M2 accept warmer / less windy / not exposed to snow or other stated weather impacts / controls weather / controls (sun)light / protect from UV M3 accept no bugs M4 accept ease of application of fertiliser / pesticide
2(c)(iii)	(greatest) increase (in plant height);	1	ignore impacts or changes height accept more growth / grows the tallest / grow more / grow bigger or taller accept plants grow 18 cm taller than control / plants grow 26 cm taller than C accept gives best results and as it grows to 160 cm
2(c)(iv)	lowest height / slowest growth (than control or overall);	1	guidance: we are looking for ref. to height or growth ignore worse or least effective or least successful / shrink / decrease or reduce growth / does not help to grow ignore negative impact ignore low growth unqualified (as not comparative) accept low growth or limits or stunts growth compared to control or other fertilisers accept C could be toxic accept lower growth / slower growth accept shortest plant // negative impact on height / detrimental to growth / only grew to 135 cm / grew the least

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Question	Answer	Marks	Guidance
2(c)(v)	<i>any one from:</i> M1 enables anomalies or outliers to be identified; M2 enables a trend or pattern to be identified; M3 reduces impact of anomalies; M4 increases, reliability or validity (of results);	1	ignore similar ignore comparison unqualified M2 ignore to find a mean or average M2 accept check result is not a one time result / repeatability of results / checks that result is the same every time / confirm results / obtain concordant results / consistency of results M4 ignore increases accuracy / mistakes / errors / bias / representative / reproducible M4 accept reduces effect of <u>random error</u>
2(d)	M1 3–4 in consecutive order; M2 all 5 in correct order ; control→A→C→polyhalite→B	2	allow [1] for order reversed, e.g. B→polyhalite→C→A→control M1 guidance: A→C→polyhalite→B→control gets M1 as there are 3 in consecutive order (A→C→polyhalite) A→C→polyhalite→B→A gets M1 as there are 3 in consecutive order (A→C→polyhalite) accept poly or P for polyhalite or PH or other clear indications of polyhalite

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Question	Answer	Marks	Guidance
2(e)(i)	<i>any three reduced stated impacts on national park:</i> M1 less mine vehicles (on surface) / fewer roads (built); M2 reduced air pollution or reduction in named atmospheric pollutant, e.g. carbon dioxide / dust; M3 reduced <u>visual pollution</u>; M4 reduced noise pollution; M5 less deforestation / less habitat loss / less biodiversity loss; M6 less chance of (habitat) fragmentation; M7 land on surface can be used for other (national park) purposes; M8 less negative impact on tourism; M9 AVP, e.g. less migration of animals / breeding patterns not disrupted;	3	guidance: ignore repetition of content in stem, e.g. polyhalite transported underground / all buildings below ground ignore less impact unqualified ignore does not affect or disturb surface ignore reduces pollutants unqualified ignore plants or animals not disturbed or disrupted or damage, unqualified M1 ignore less cars or vehicles unqualified M1 accept less cars for the mine / less lorries / less trucks / less congestion M1 accept less waste transported (on surface) M3 ignore not visible on the surface / appearance unqualified / beauty / eyesore M3 accept reduced light pollution M4 accept no sound disruption / reduced sound pollution M5 accept less vegetation loss / less plant life destroyed
2(e)(ii)	<i>any two from:</i> M1 increased number of jobs; M2 increase in economy; M3 improved, infrastructure / roads / transport links;	2	ignore benefits of being an underground mine ignore cost / availability of polyhalite / fertiliser M1 accept job opportunities M2 accept idea of generates money / puts profit into the area / benefits economy / increases GDP / provides income M2 accept multiplier effect / income from tourism not affected

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Question	Answer	Marks	Guidance
3(a)	<i>any three from:</i> M1 idea of high temperatures and that last for long period of time; M2 increased evaporation / removes moisture from ground / dries out land or vegetation or soil; M3 low rainfall / drought conditions; M4 (increased) winds and cause wild fires to spread; M5 increases chance of lightning (due to increased frequency of storms);	3	ignore extreme weather unqualified ignore high temperature unqualified ignore dry season unqualified M1 CON if ozone referenced M2 accept drier leaves M2 accept <u>dry</u> vegetation burns easier M2 accept faster evaporation M3 ignore change in rainfall / low water unqualified M3 accept lower (relative) humidity / arid conditions M3 accept lack of water to put out wild fires M5 ignore thunderstorms
3(b)(i)	9;	1	ignore any workings or calculations
3(b)(ii)	<i>any two from:</i> M1 2023 may be anomalous or an outlier; M2 only shows a 40-year period; M3 no trend / data fluctuates; M4 other (non-climate change) factors could cause increase or stated reason, e.g. arson / change in land use; M5 data is only from one country; M6 graph does not include data on (Earth or global) temperature;	2	ignore climate change not shown on graph M1 ignore other quoted years as outliers M1 accept increase from 2022 to 2023 is too rapid to be due to climate change M1 accept only one year has large number of wildfires / only one year has (large) spike in data M3 accept data is sporadic / data random pattern / scattered pattern / there are several spikes in the data / no consistent increase / goes up and down / (data) not linear M4 ignore correlation does not equal causation / no correlation M4 accept other cause of the wild fires

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Question	Answer	Marks	Guidance
3(c)	<i>any two from:</i> M1 loss of, property / infrastructure; M2 economic decrease / loss of jobs; M3 (forced) migration; M4 loss of or reduces biodiversity / disruption of food chains; M5 loss of, habitat / ecosystems; M6 decrease in crop yields / reduction in food / (increases) food insecurity / loss of livestock / loss of agriculture (land); M7 air pollution or stated example, e.g. carbon dioxide emission; M8 water pollution / idea of fighting fires leads to reduced availability of drinking water / water insecurity;	2	ignore death of people or animals or plants ignore health (physical and mental and panic) issues ignore land insecurity / ecological destruction / loss of land / resources ignore soil quality ignore photosynthesis M1 accept damage to homes (<i>damage is usually ignored but accepted in this context</i>) M2 accept higher, insurance costs / taxes / cost to rebuild M2 accept less <u>timber</u> / less wood to use for construction or fuel or other stated use, e.g. for paper M3 accept migration of people or animals M4 accept decreases biodiversity M5 accept loss of vegetation / deforestation / loss of trees M7 accept creates, smog / haze / smoke / reduces visibility M7 accept release of, particulates / soot / carbon monoxide / greenhouse gases / GHG / contributes to climate change or global warming / degrades air quality / poor or low air quality / methane / release of carbon / reduces carbon sinks or stores (as trees burnt)

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Question	Answer	Marks	Guidance
3(d)(i)	<i>any two from:</i> M1 above average in, north / central west / western central / mid-west; M2 average, in interior / in some areas of north or south; M3 below average in, south / south west / south east / east / west; M4 (approximately) <u>half</u> of Australia has, average and above average or below average (rainfall);	2	ignore descriptions that do not match key, e.g. ignore 'increased' / 'most' / lower / majority ignore non compass points descriptors, e.g. above / below / left / right / top / bottom / upper / lower accept centre / interior / middle to mean central M2 accept scattered / borders above average or below average areas / between above and below average areas M3 ignore north M3 accept scattered M4 ignore most of region M4 accept stated territory and correct description, e.g. above average in centre of Tasmania or in island off coast of mainland / below average in Victoria

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Question	Answer	Marks	Guidance
3(d)(ii)	<i>any three from:</i> M1 contamination of, water / groundwater / aquifers / water bodies / water source; M2 contamination by stated pollutant, e.g. sewage / harmful or toxic substances / chemicals; M3 (leads to) lack of, drinking water / water for stated purpose, e.g. irrigation / washing / flushing toilets / sanitation; M4 idea of reduced access to water / people cannot get to water; M5 destroys, pipelines / pumps / water treatment plants / infrastructure / pipes / wells;	3	ignore water insecurity ignore unclean or dirty water ignore recharge of aquifers M1 accept water not safe to drink / polluted water mixes with drinking water / water becomes polluted / less safe drinking water M2 ignore malaria / make people sick M2 accept increases the salinity of drinking water / sea water or salt water (intrusion) / waste M2 accept stated water-related disease, e.g. cholera / bacteria M3 accept scarce to mean lack of M4 accept people cannot leave homes to get water M4 accept cost of water increase
3(d)(iii)	<i>any three from:</i> M1 increase <u>interception</u>; M2 rain hits ground with less, force or speed / rate rain hits soil decreases; M3 increases <u>infiltration</u>; M4 trees take up water by <u>roots</u> / <u>roots</u> absorb water; M5 improve soil structure or drainage; M6 reduces <u>run-off</u>;	3	ignore increases evapotranspiration / increases transpiration / increases evaporation M1 M3 M6 guidance: we are looking for the key terminology, e.g. interception or intercept(ed) / infiltration or infiltrate(d) / run-off M1 M3 M6 guidance: award credit for idea that presence of trees will enable interception or infiltration and absence of trees means run-off does occur M4 ignore blocks path of water M5 accept reduces risk of soil erosion / reduces risk of sedimentation / reduces soil movement M5 accept increased water storage (underground)

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Question	Answer	Marks	Guidance
4(a)	M1 method of dividing up the forest, e.g. grid / coordinates / GPS; M2 stated random method of selection, e.g. number generator;	2	M1 accept use a grid quadrat / divide the forest into different equal sized areas or numbered equal sized areas using a map M2 CON references to systematic sampling M2 accept randomly select numbers / use randomised numbers / use random number generation / roll dice / pick squares out of a hat / use AI to randomly pick
4(b)	<i>any four from:</i> M1 tap / hit / shake, one plant; M2 (beat for) stated period of time; M3 count the, total number of insects / number of insect species (collected on tray); M4 stated method of identifying the species, e.g. use of a key or book or photographs or internet; M5 repeat for, different plants / location / time, AND calculate a mean;	4	ignore location of tray or placing tray M1 accept beat plant with a stick / beat the plant M2 accept idea of beating for same number of times M3 ignore amount / record number / determine / measure / see how many there are / check number / measure number M3 accept count insects M4 accept use a database M5 ignore repeat unqualified M5 ignore repeat each month M5 accept repeat for another year / repeat at different part of tree / repeat the method AND calculate a mean M5 accept average for 'mean'
4(c)(i)	3340 circled;	1	CON right + wrong answer accept other methods of indicating right answer but circling takes precedence

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Question	Answer	Marks	Guidance
4(c)(ii)	<i>any two from:</i> M1 pitfall trap may contain bait / insects attracted to pitfall trap; M2 insects cannot escape once in pitfall trap; M3 pitfall trap is left for longer periods of time; M4 not all individuals fall from the tree into beating tray / beating tray depends on where beating takes place on plant, e.g. at top or bottom;	2	ignore more effective method unqualified ignore area covered ignore pitfall trap holds more insects M1 ignore more insects on the ground than in the plant M1 ignore pitfall trap camouflaged M2 ORA insects can fly away or escape from beating tray M3 ORA beating tray collects for shorter period of time
4(c)(iii)	<i>any one from:</i> M1 risk of insects, harmed / injured / eaten / drowned; M2 larger insects not captured; M3 not suitable for flying insects; M4 collection success influenced by environmental factors, e.g. temperature, rainfall, windy;	1	ignore cost guidance accept animals to mean insects M1 ignore insects die unqualified M1 accept predators can get into the trap / fill with water M2 accept only small insects trapped M3 accept not suitable for winged insects / ora: mainly or only collects ground or crawling insects
4(d)(i)	40;	1	R 39(.3005089)
4(d)(ii)	0.72;	1	ignore 0.7 accept absence of zero before decimal point, e.g.: .72 accept comma for decimal point, e.g. 0,72 accept 0.7165 / 0.717 / 0.716

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Question	Answer	Marks	Guidance
4(d)(iii)	less or decreased, diversity / biodiversity;	1	ignore errors ignore climate change / global warming ignore population decline ignore decrease in number of insects or animals accept lower number of different insects or animals accept lower number of insect or animal, species accept lower species richness / lower species evenness accept some of forest has been cut down accept invasive species introduced / increase in predation / increase in migration accept less variety of species
4(e)	<i>any three from:</i> M1 reproduce quicker / have no (natural) predators; M2 <u>outcompete</u> native species / compete for or deplete stated resources, e.g. food / water / sunlight / nutrients / nesting sites; M3 prey on or are predators of, native species; M4 introduce disease;	3	ignore harm / disrupt ignore migration / relocation M1 accept reproduce fast M2 ignore homes M2 accept competition for space or habitat or land M2 accept take over a habitat / alter habitat M3 ignore alter or disrupt food chain / kill native species, unqualified M3 accept consume or eat native species or the other animals

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Question	Answer	Marks	Guidance
5(a)	stratosphere;	1	R stratopause accept slight spelling errors, e.g. sratosphere
5(b)	CFCs / chlorofluorocarbons;	1	ignore products that contain ODS, e.g. refrigerant guidance: you will need to check whether a substance is ozone depleting if a candidate gives something that is not included in the mark scheme accept other correct substances other correct examples: chlorine / halons / hydrochlorofluorocarbons / HCFCs / carbon tetrachloride / CCl_4 / methyl bromide / 1,1,1-trichloroethane / methyl chloroform / HBFCs / hydrobromofluorocarbons / bromochloromethane / nitrous oxide guidance: an incorrect substance CONs a correct one common incorrect answers: carbon / carbon dioxide / carbon monoxide / methane / sulfur dioxide / photochemical smog
5(c)	100;	1	ignore < or $\leq$ sign R > 100 or $\geq$ 100

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Question	Answer	Marks	Guidance
5(d)(i)	<i>any four from:</i> M1 Montreal and Copenhagen reduce (skin cancer) / Montreal reduces skin cancer / Copenhagen reduces (skin cancer); M2 Copenhagen most effective or most successful / Montreal least or less effective; M3 Copenhagen close to zero or less than 200 / Copenhagen goes (back) to zero; M4 Montreal still has (overall) increase (in skin cancer compared to others); M5 manipulated comparative data, e.g. Montreal compared to no agreement is 4500 fewer cases (in 2100) / Montreal compared to Copenhagen 1950 more cases (in 2100);	4	accept protocol to mean Montreal accept amendment to mean Copenhagen accept impact to mean skin cancer throughout in the context of this question only M1 accept reduce / goes down / less to mean reduce M2 guidance: we are looking for a comparative statement M2 accept Copenhagen has the greatest impact / Copenhagen decreases skin cancer the most M1 M2 guidance: Copenhagen reduces skin cancer the most gets [2] marks (M1 for reducing skin cancer and M2 for the idea of the most effective) M1 M3 guidance: Copenhagen decreases to 0 gets [2] marks (M1 for decreases and M3 for close to zero) M3 accept Copenhagen eliminates cases M5 ignore per million or million with data M5 accept ± 100 for any manipulated data quotes M5 accept Montreal reduced by more than half
5(d)(ii)	cataracts;	1	ignore cancer ignore eye infection / eye damage / photokeratitis / snow blindness / affect or damage vision / eye issues or eye irritation accept macular degeneration / premature skin aging / skin damage / sunburn

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Question	Answer	Marks	Guidance
5(e)	not backed up by, experiments or evidence;	1	ignore knowledge / thought it was a hoax / ozone not considered a risk / understanding accept lack of proof / not enough research / too little information in the data / not enough data / lack of direct atmospheric measurements / not tested / no way to measure the ozone concentration accept only secondary information / not enough primary sources / were not sure how to test the theory
5(f)	idea of ozone 'hole' or ozone depletion had not been discovered in 1959 or when treaty first signed;	1	accept ozone hole discovered after treaty / hole was unknown at the time / not well researched at that time / concept was not fully understood / lack of knowledge or evidence on it / ozone hole not of great concern