



## Cambridge International AS Level

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**ENVIRONMENTAL MANAGEMENT**

**8291/21**

Paper 2 Management in Context

**May/June 2022**

MARK SCHEME

Maximum Mark: 80

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **17** printed pages.

**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct / valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

**Science-Specific Marking Principles**

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|---|--|
| 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 | <p><u>'List rule' guidance</u></p> <p>For questions that require <i>n</i> responses (e.g. State <b>two</b> reasons ...):</p> <ul style="list-style-type: none"><li>• The response should be read as continuous prose, even when numbered answer spaces are provided.</li><li>• Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>.</li><li>• Incorrect responses should not be awarded credit but will still count towards <i>n</i>.</li><li>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should <b>not</b> 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.</li><li>• Non-contradictory responses after the first <i>n</i> responses may be ignored even if they include incorrect science.</li></ul> |

**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.

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Question	Answer	Marks
	<p><i>In general ignore the follow if unqualified:</i></p> <p><i>pollution</i>  <i>land pollution</i>  <i>death</i>  <i>harms health</i>  <i>harms the environment</i>  <i>not environmentally friendly</i>  <i>affects environment / people</i>  <i>standard of living</i>  <i>resources</i></p> <p><b>accept</b> alternate wording</p> <p><i>allow development where stated</i></p> <p><i>underlined terms are specially required for the marking point, although accept phonetic spellings</i>  <i>guidance allow are extra marking points unless referenced to numbered marking point e.g. M1 or qualified e.g. <b>accept</b> CH<sub>4</sub> for methane</i></p> <p><b>allow</b> CO<sub>2</sub> CO<sup>2</sup> Co2 co2</p>	

Question	Answer	Marks
1(a)(i)	<p><i>any three from:</i></p> <p>(methane is a) <u>greenhouse</u> gas;  (methane) contributes to climate change / global warming or described / enhanced greenhouse effect;  methane has greater impact (on global warming) than CO<sub>2</sub> / methane has higher global warming potential or higher GWP than CO<sub>2</sub>;  (methane is) non-renewable / finite;  (alternative source of fuel) increases energy security;  non-CO<sub>2</sub> emitting gases needed to meet carbon targets / investment in carbon neutral fuels / need to reduce carbon emissions for target / comply with international agreements;</p>	<b>3</b>
1(a)(ii)	<p><i>any two from:</i></p> <p>economic reason;  lack of infrastructure / may need new equipment;  trial might be unsuccessful;  alternative energy resources available;  trial still uses, methane / greenhouse gas;  people against the idea / lack of agreement / large population to convince;</p>	<b>2</b>
1(a)(iii)	<p><i>any two from:</i></p> <p>carbon capture;  named strategy;  carbon, storage / sink; M2  named strategy e.g. underground, oceans, aquifers, fossil fuel seams;  plant more trees / afforestation / reforestation;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(b)(i)	<p><i>any four comparative trends:</i></p> <p>higher or more overall consumption in HICs / HICs double;  HICs starting % higher;  HICs AND LICs overall decrease (from 1970–2015);  HICs (steadier) decrease AND LICs fluctuates;  comparative year trend or data quote from a HIC AND a LIC to support trend e.g. 1970–1985 LICs increase as HICs decrease / HIC 95(%) LIC at 33(%) in 1970 / HICs use 60–65% more / 1970–2015 or overall HICs slight fluctuation AND LICs more fluctuation;</p>	<b>4</b>
1(b)(ii)	<p><i>any two from:</i></p> <p>economic issue;  reliance on import / reliant on another country;  conflict (between countries);  delays or disruption in supply e.g. could be cut-of / embargo / restrictions on trade / instability in export country / natural disasters / new laws / climate change quotas;</p>	<b>2</b>



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(i)	2;	<b>1</b>
2(a)(ii)	Germany: 3120; Finland: 13 440;	<b>2</b>
2(a)(iii)	<p><i>any two from:</i></p> <p>education / advertising / raise awareness;            economic incentive / economic penalty;            legislation / laws / regulations;            increase, availability of recycling points / accessibility;            idea of simple / easy recycling, system;</p>	<b>2</b>
2(a)(iv)	<p><i>max [4] total:</i></p> <p><i>max three benefits:</i>            can be used for, heating / electricity or provides a form of energy;            idea of gets rid of large quantities of waste / doesn't take up (land) space / land can be used for other purpose;            avoids landfill / landfills full;            idea of reduces named pollution e.g. water pollution / leaching / plastics in ocean / soil pollution / smell / visual pollution;            reduces methane production (compared to landfills);</p> <p><i>max three negative impacts:</i>            release of toxic / poisonous / <u>acid</u>(ic), gases or substances or chemicals;            produces ash / particulates / smoke / smog;            produces carbon dioxide / greenhouse gas ;            leads to respiratory / breathing problem / lung problem / named condition e.g. asthma;            some things cannot be burnt;</p>	<b>4</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(a)(v)	<p><i>any four or developed argument from:</i></p> <p><i>benefits:</i>            Europe, has disposed of its waste / has less need for landfill;            waste can be reused or repurposed or recycle in import country            import country gains money;            more jobs (in import country);</p> <p><i>negatives:</i>            import country has to pay for disposal;            increases waste in import country / waste still hasn't been disposed of;            creates imbalance between HICs and LICs / shifting the responsibility onto LIC;            stated pollution event related to waste disposal in import country e.g. increased air pollution / increased carbon footprint;            transport costs / energy implication of transport; e.g. uses fossil fuels            stated pollution event related to transporting e.g. produces CO<sub>2</sub> during transport / leakage / increases carbon footprint</p>	<b>4</b>
2(b)(i)	<p><i>any one from:</i></p> <p>sewage is hazardous / contains diseases / leakage during transport / ocean pollution;            food decomposes / biodegradable;            smell;            quantities too large to transport;</p>	<b>1</b>
2(b)(ii)	<p><i>any two from:</i></p> <p>part of (Antarctic) treaty / international agreement;            stated pollution e.g. visual / plastics in ocean / pristine environment;            stated example of harm to animals or plants e.g. reduce biodiversity / disrupts food chains;            introduce diseases;</p>	<b>2</b>

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Question	Answer	Marks
2(c)	<p><i>any three from:</i></p> <p>permit for travel;  rules on what can be taken in or out;  restricted / limited, numbers / restrictions on who can enter;  restrictions on time of year;  restricted areas / zoning of areas / controlled areas / areas for just scientists / no go areas / limited entry points / named  method of zoning / create national park;  regulated tour providers only / guides needed;  state or government-controlled facilities;  high cost to enter area;  controlled method of transport;  fines;</p>	<b>3</b>

Question	Answer	Marks
3(a)(i)	<p><i>any one from:</i></p> <p>increased (human) population;  (increased) urbanisation / electricity more accessible / (more) industrialised;  decreased cost of lights;  increase in wealth for some people / people can afford electricity / decrease cost of electricity;</p>	<b>1</b>
3(a)(ii)	<p><i>any two or developed from:</i></p> <p>insects are pollinators;  reduce food crops / less food for people;  loss of <u>biodiversity</u> / disrupting <u>food chain</u> / <u>food web</u>;  insects, are food for other animals / are decomposers;  biological control;</p>	<b>2</b>
3(b)(i)	250;	<b>1</b>
3(b)(ii)	<p><b>A:</b> every 4 days;  <b>B:</b> no spray;</p>	<b>2</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
3(b)(iii)	<p><i>any two or developed from:</i></p> <p>pest resistant crops / GM crops;            biological control;            companion planting / planting sacrificial plants;            mechanical control or named example picking pest by hand / nets / cages / pheromone traps;            release sterile insects;</p>	<b>2</b>
3(b)(iv)	<p>random (sampling);</p> <p><i>method described:</i>            each field given a number or letter / use a grid;            three fields picked from a hat / number generator;</p>	<b>3</b>
3(b)(v)	<p><i>max [4] total:</i></p> <p><i>max three benefits:</i>            (equipment is) inexpensive;            easy to use / little training needed;            lots of insects collected;            insects not harmed / insects are alive;            crops not harmed;</p> <p><i>max three limitations:</i>            does not work well in short or dense vegetation / doesn't sample from within vegetation;            net easily damaged;            labour intensive / time consuming / non-automatic / a person has to do it;            in-built bias / choose where to sweep;            non-selective for type of insect;            insects, escape / fall out / fly out / move away from net / doesn't collect insects that attach firmly to vegetation;</p>	<b>4</b>

Question	Answer	Marks
4(a)(i)	<p><i>any one from:</i></p> <p>satellite;  geospatial systems / geographical information systems / GIS;  crowd sourcing / surveying;  arial photographs / drones;</p>	<b>1</b>
4(a)(ii)	<p><i>any two or developed from:</i></p> <p><u>habitat</u> lost / <u>habitat fragmentation</u>;  reduces food / disrupts <u>food chains or web</u> / increase competition / reduces <u>carrying capacity</u>;  increased predation / less protection from predators;  disrupts ecological corridors;  changes land use / primary forest replaced by secondary forest;  causes migration (of species);  soil erosion;  loss of, soil fertility / soil structure;</p>	<b>2</b>
4(b)(i)	forest cover is decreasing;	<b>1</b>
4(b)(ii)	<p>sectors in rank order largest first beginning at noon and proceeding <u>clockwise</u>;</p> <p>correct plotting <math>\pm 1\%</math>;</p> <p>sectors match key;</p>	<b>3</b>
4(b)(iii)	<p><i>any one from:</i></p> <p>sample size;  we need information on the method of collection;  demographic / information about who has been sampled;</p>	<b>1</b>

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Question	Answer	Marks
4(c)(i)	<p><i>any one from:</i></p> <p>lack of water;  disease;  soil infertile / lack of nutrients;  natural disaster / wildfires;  eaten by livestock or animals;  competition or described;  tree stolen / damaged by people;  removed as part of forest management / trees cut down / trees harvested;</p>	<b>1</b>
4(c)(ii)	<p><i>any one from:</i></p> <p>cost;  other priorities / not seen as important;  public or political opinion / lack of volunteers to plant them;  lack of land / area already forested;</p>	<b>1</b>
4(c)(iii)	<p><i>any two from:</i></p> <p>improved soil e.g. improved structure / <u>roots</u> bind soil / improved nutrients / improved fertility;  reduces global warming / reduces global temperatures;  decreases <u>evaporation</u> from soil;  increases <u>interception</u>;  increases <u>infiltration</u>  decreases <u>run-off</u>.  increases (evapo)<u>transpiration</u> / increased water <u>evaporating</u> from leaves;  leads to, moisture condenses / increases cloud cover / more precipitation;</p> <p><i>any one from:</i></p> <p>soil can absorb more water / soil can hold more water / water can soak into soil;  increases or recharge <u>groundwater</u> stores / recharges aquifers;</p>	<b>3</b>

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Question	Answer	Marks
4(c)(iv)	<p><i>any three from:</i></p> <p>could become <u>invasive</u>;            out compete native trees / deplete nutrients / increased competition in food chain / competition described / disrupt food chain / loss of <u>biodiversity</u>;            no natural predators / not (local) food source            toxic / poisonous;            diseases;</p>	<b>3</b>
4(c)(v)	<p><i>any four or developed from:</i></p> <p>(growing trees are) carbon <u>capture</u> or <u>sinks</u>;            (mature trees are) carbon <u>stores</u>;            during photosynthesis;            reduce <u>carbon dioxide</u> / <u>CO<sub>2</sub></u> (from atmosphere);            carbon dioxide + water → glucose + oxygen  <b>OR</b> <math>6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2</math> ;</p>	<b>4</b>

Question	Answer	Marks
5(a)	<p><i>for solar stove:</i></p> <p><i>max [5] advantages of solar stove:</i>  renewable energy;  solar energy or sun is free to use;  uses existing / local / same, materials for stove;  saves time collecting fuel;  does not produce smoke / smog / particulates / carbon dioxide emissions / produce carbon monoxide / less air pollution;  does not cause respiratory disease / breathing difficulties / lung cancer / eye irritation / stated condition related to CO / named condition;  not cutting down trees / less deforestation ;  less risk of (uncontrolled) fires</p> <p><i>max [5] disadvantages of solar stove:</i>  expense of shiny surface;  less reliable / can only be used, when or where sunny / at certain times of day / mealtimes must fit in with weather / less flexible use;  used outside;  not sturdy construction;  food takes longer to cook;  does not provide ash for use on soils;  harder to build shiny surface / don't have skills to self-build a shiny surface;</p>	<b>6</b>
5(b)(i)	<p><i>any one from:</i></p> <p>regions can be (directly) compared;  different regions have different numbers of people;</p>	<b>1</b>
5(b)(ii)	<p><i>any three from low income people:</i></p> <p>greater number of homes with indoor wood / dung / open fire / unventilated stoves;  have less access to electricity / less supply of (natural) gas / no alternatives to current fuel;  homes not ventilated / limited technology or advancements;  have more people per home / homes overcrowded;  less access to medical facilities / poorer overall health;  limited education;</p>	<b>3</b>



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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
5(c)(i)	<p><i>any one from:</i></p> <p>origin of pollution not known / difficult to prove who caused the pollution / pollution comes from different countries;            too many people cause the pollution / everyone contributes to pollution;            lack of funds / lack of money / negative impact on economy;            difficult to define pollution;            some countries / people, have different priorities;            pressure from (large) companies / lobbying;</p>	<b>1</b>
5(c)(ii)	<p><i>any two from:</i></p> <p>economic reason;            leads to loss of jobs;            lack of alternatives e.g. no widespread electric vehicle use / lack of control over personal carbon footprint</p>	<b>2</b>