



# Cambridge International AS Level

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**ENVIRONMENTAL MANAGEMENT**

**8291/21**

Paper 2 Management in Context

**May/June 2023**

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.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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This document consists of **11** 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**

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 'List rule' guidance

For questions that require *n* responses (e.g. State **two** reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided.
- Any response marked *ignore* in the mark scheme should not count towards *n*.
- Incorrect responses should not be awarded credit but will still count towards *n*.
- 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 *n* 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.

Question	Answer	Marks
1(a)	M1 <u>natural</u> gas; M2 coal;	2
1(b)(i)	<i>any three from:</i> M1 reduce, use / wastage of water; M2 reduce risk of <b>water</b> insecurity; M3 reduce energy used; M4 reduce risk of <b>energy</b> insecurity; M5 reduce costs;	3
1(b)(ii)	<i>any three suggestions:</i> M1 contamination of <b>soil</b> ; M2 water pollution / pollution of named water source e.g. rivers / reservoir / drinking water supplies / groundwater; M3 (water pollution) toxic contents (to wildlife) / reduce biodiversity / disrupt food chains; M4 bioaccumulation; M5 description e.g. build up of toxins in an organism; M6 biomagnification; M7 description e.g. build up of toxins up a food chain; M8 (tail ponds) risk of collapse / flooding / stated flooding impact;	3
1(c)	<i>any three from:</i> M1 land locked / not near a port / can't export by sea; M2 (road transport) leads to congestion; M3 (road transport) leads to noise/visual/air, pollution or increased carbon emissions; M4 currently no pipeline; M5 (pipeline or oil spill) causes habitat / biodiversity, loss; M6 cost of oil to consumer becomes expensive / transport expensive (as remote location/transport); M7 risk of oil spills / risk of water pollution; M8 <i>stated other negative reference to the rivers:</i> idea of lots of rivers / surrounded by rivers / need to cross rivers / difficult to cross in winter / disruption to flow of rivers; M9 public / political, opposition; M10 idea of long distance to export country / crossing international borders;	3

Question	Answer	Marks
1(d)(i)	<p><i>any three comparisons from:</i>  M1 oil sands, starts lower / ends higher (than conventional) / ora;  M2 similar trend / both have an (overall) increase;  M3 oil sands increased <b>AND</b> conventional remains constant;  M4 from 2011 oil sands increase more / ora;  M5 both peak in 2019;  M6 both fluctuate;  M7 equal production in (end of) 2010 or 2011;  M8 comparative paired quoted data;  e.g. comparative, number of barrels / specific year trends</p>	<b>3</b>
1(d)(ii)	<p>M1 <math>4\ 800 \div 142\ 200 (\times 100) / 3.375527 / 3.376 / 3.38</math>;  M2 3.4;</p>	<b>2</b>
1(d)(iii)	<p>M1 oil, is non-renewable / finite / will run out;  M2 prices will increase as availability decreases / demand will be greater than supply;  M3 idea of having to rely on imported fossil fuels or imported electricity / dependence on another country;</p>	<b>2</b>
1(e)(i)	<p><i>any three from:</i>  M1 greenhouse gases absorb (infrared) radiation;  M2 lead to <b>enhanced</b> greenhouse effect / increased global, temperatures / (global) warming;  M3 causes climate change;  M4 stated effect of climate change e.g. sea level rise, animal extinction / increased migration, reduction of ice sheets / wildfires / disrupt weather <b>patterns</b>;</p>	<b>3</b>
1(e)(ii)	<p><i>any two from:</i>  M1 idea of, working together / global cooperation;  M2 idea of, no borders in atmosphere / (greenhouse) emissions or pollutants are global;  M3 finance / support, needed for LIC;  M4 raises awareness;  M5 <i>incentive to follow agreement due to:</i>  financial penalties for countries who break the agreement / (international) enforcement / international standards / targets or limits or rules <b>everyone</b> must follow / international accountability / political or international pressure to follow the agreement;</p>	<b>2</b>

Question	Answer	Marks
1(e)(iii)	<i>any two from:</i> M1 improved or newer technology; M2 idea of more efficient extraction; M3 pressure from environmental groups (for emission reduction); M4 reduced extraction / limits on extraction; M5 AVP;;	<b>2</b>
1(f)	<i>any three from:</i> M1 increased jobs; M2 greater availability of oil / increased energy security / more consistent supply of oil; M3 leading to lower oil prices / reduces import cost; M4 improved, local facilities / infrastructure; M5 reduces impacts of overland transport / less vehicles needed / less risk of stated pollution related to transport e.g. oil spill, air pollution, noise pollution; M6 reduces cost of transport; M7 idea of benefitting economy of country or company;	<b>3</b>

Question	Answer	Marks
2(a)(i)	idea of (atmospheric) deposits with a pH < 5.6;	<b>1</b>
2(a)(ii)	<i>any three from:</i> M1 combustion or burning of fossil fuels; M2 formation sulfur dioxide or SO <sub>2</sub> / sulfur reacts with oxygen / $S + O_2 \rightarrow SO_2$ ; M3 (their M2) gas reacts with water or H <sub>2</sub> O; M4 to form sulfuric acid / H <sub>2</sub> SO <sub>4</sub> ;	<b>3</b>
2(a)(iii)	<i>any three strategies/developments from:</i> M1 reduce use of fossil fuels / use renewable resources / use stated renewable resource; SO <sub>2</sub> : M2 flue gas desulfurisation / <u>flue</u> gas removal from chimneys; M3 fuel <u>desulfurisation</u> ; NO <sub>x</sub> : M4 catalytic convertors;	<b>3</b>

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<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(b)(i)	1.6;	<b>1</b>
2(b)(ii)	anomalous data point / outlier;	<b>1</b>
2(b)(iii)	<i>any two from:</i> M1 pH values similar / sulfate concentrations vary, at each location; M2 low pH / acidic pH / pH less than drinking water; M3 high (concentration of) sulfate / more (concentrated with) sulfate than drinking water; M4 idea that (reservoir) water affected by acid deposition;	<b>2</b>
2(b)(iv)	to remove any impurities from the bottle;	<b>1</b>
2(b)(v)	<i>any two from:</i> M1 time; M2 water temperature; M3 air temperature; M4 weather conditions; M5 water depth of sample; M6 volume of water collected;	<b>2</b>
2(b)(vi)	<i>any two from:</i> M1 more (than 3) locations; M2 not all in one place / spread out sampling; M3 longer sampling period / more than three years of sampling / more than once a month; M4 different depths;	<b>2</b>
2(c)(i)	plankton;	<b>1</b>
2(c)(ii)	second;	<b>1</b>



Question	Answer	Marks
2(c)(iii)	<p><i>any three from:</i>  M1 lost as heat;  M2 idea of only 10% of energy passed between levels / 90% is lost;  <i>lost through:</i>  M3 respiration;  M4 digestion;  M5 (excreted) waste (products);  M6 movement;  M7 death / decomposition;  M8 maintaining body temperature / thermoregulation;  M9 feeding / consumers do not consume the whole organism;</p>	<b>3</b>

Question	Answer	Marks
3(a)(i)	<p>M1 two correct plots;  M2 bars same width as existing bars;</p>	<b>2</b>
3(a)(ii)	1999 <b>AND</b> 2000;	<b>1</b>
3(a)(iii)	<p><i>any three from:</i>  M1 population increase;  M2 logging / timber;  M3 (wild)fire;  M4 drought / lack of water;  M5 disease;  M6 invasive species;  M7 (bio) fuels;  <i>land needed for:</i>  M8 housing / buildings / urbanisation / industrialisation / construction / commercial / business;  M9 roads / infrastructure;  M10 agriculture / production of food / grazing / crops / farms;  M11 mineral extraction / mining;  M12 hydroelectric / reservoirs;</p>	<b>3</b>

Question	Answer	Marks
3(b)	<p><i>any three from:</i>  M1 <i>idea of:</i> (\$21 million of) Brazil's debt (to USA) cancelled;  <i>money is then invested in ways to improve the forest:</i>  M2 idea of preserving or increasing biodiversity;  M3 ecotourism;  M4 national parks;  M5 afforestation / re-forestation / replanting;  M6 compensating farmers / helping people financially / financial incentive to individuals (to not cut down trees);</p>	3
3(c)(i)	<p><i>any three from:</i>  M1 no information on number of houses in street;  M2 may be too much data or too little data, to analyse;  M3 only women selected / ora;  M4 only 20–30 year olds selected / no stated other age range;  M5 only Sao Paulo selected / only one street or area selected;  M6 data is not representative;  M7 data could be biased;</p>	3
3(c)(ii)	quick or easy / do not have to read long responses / answers are limited or quantifiable / not ambiguous / does not need interpretation / AVP;	1

Question	Answer	Marks
4(a)(i)	<p><b>yes</b> because  <i>per day:</i>  <b>M1</b> (<math>49 \div 7 =</math>) <b>7</b> (litres) needed per person a day;  <b>M2</b> (<math>7 \times 5 =</math>) <b>35</b> (litres) needed for all the scientists a day (which is less than WRS 127 litres produced each day);</p> <p><b>OR</b>  <i>total for 60 days:</i>  <b>M1</b> (<math>420 \times 5 =</math>) <b>2100</b> (litres) total needed for 60 days and 5 scientists;  <b>M2</b> (<math>127 \times 60 =</math>) <b>7620</b> (litres) WRS produces in 60 days;</p>	2

Question	Answer	Marks
4(a)(ii)	<p><i>any two from:</i>  M1 weighs too much;  M2 requires a lot of energy to carry;  M3 takes up too much space / difficult to store;</p>	<b>2</b>
4(a)(iii)	<p><i>any three from:</i>  M1 chemical reaction (in cells);  M2 that breaks down glucose;  M3 requires oxygen;  M4 releases energy;  M5 produces carbon dioxide <b>AND</b> water;</p>	<b>3</b>
4(b)	<p><i>max [4] benefits:</i>  M1 do not need a source of water / suitable in arid areas / can be used during drought / idea that <b>dirty water</b> can be used;  M2 no wastage of water;  M3 efficient (as 93% of water can be recycled);  M4 idea that method or distillation is reliable;</p> <p><i>max [4] limitations:</i>  M5 people might not use it / not popular;  M6 because do not like idea of drinking recycled urine etc;  M7 requires energy / not everyone has access to electricity;  M8 requires (specialist) <b>equipment</b>;</p> <p>M9 requires maintenance;  M10 people will need training on how to use WRS;</p>	<b>5</b>
4(c)	<p>M1 Sun <b>heats</b> (salt) water;  M2 water <b>evaporates</b>;  M3 (evaporated) water <b>condenses</b> on (inside of dome);</p>	<b>3</b>
4(d)	<p>M1 reduces crop yield / crops need water to grow / idea that water needed for photosynthesis;  M2 crops die / livestock die / livestock need water to live;  M3 leads to food shortages / food insecurity;</p>	<b>3</b>