



National
Qualifications
2023

2023 Environmental Science

National 5

Finalised Marking Instructions

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General marking principles for National 5 Environmental Science

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If a candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you should seek guidance from your team leader.
- (c) Where a candidate makes an error at an early stage in a multi-stage calculation, award marks for correct follow-on working in subsequent stages. Do not award marks if the error significantly reduces the complexity of the remaining stages. Apply the same principle in questions that require several stages of non-mathematical reasoning.
- (d) Award full marks for a correct final answer (including units if required) on its own with no working shown.
- (e) Candidates may access larger mark allocations fully, whether they respond in continuous prose, linked statements, or a series of discrete developed points.
- (f) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (g) In the detailed marking instructions, words separated by / are alternatives.
- (h) Do not award marks if a candidate gives two answers, where one is correct and the other is incorrect.
- (i) Where the candidate is instructed to choose one question to answer but instead answers both questions, mark both responses and award the better mark.
- (j) Award marks for a valid response, even if the response is not presented in the format expected. For example, award the mark if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested.
- (k) Candidates may use abbreviations (for example, SEPA or INNS) or chemical formulae (for example, CO₂ or H₂O) as acceptable alternatives to naming, unless required by the question, but these must be correct. For instance, chemical formulae with an incorrect subscript or superscript component (for example CO²), or full-size number (for example CO2) should not be awarded the mark.
- (l) Award marks, up to the maximum mark allocation for the question, for content that is outwith the course specification but used appropriately at the correct level for National 5.
- (m) If candidates are required to give a numerical answer, and units are not given in the stem of the question or the answer space, they must supply the units to gain the mark.
- (n) If incorrect **spelling** is used:
 - and the term is recognisable, then award the mark;
 - and the term can easily be confused with another scientific term, then do not award the mark, for example quadrat and quadrant, or nitrite and nitrate, or fractional distillation and frictional distillation;

- and the term is a mixture of other terms, then do not award the mark.

(o) When presenting data:

- for marking purposes no distinction is made between bar charts (used to show discontinuous features, have descriptions on the x -axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x -axis and have contiguous columns)
- other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not award the plotting mark. Marks may still be awarded for other required components, as specified in the detailed marking instructions.
- do not award the relevant mark if the graph too small to check the accuracy of plotting; or if 0 is plotted when no data for this is given (ie candidates should only plot the data given)

(p) Award marks only for a valid response to the question asked. For example, in response to questions that ask candidates to:

- **identify, name, give, or state**, they need only name or present in brief form;
- **define**, they should give a statement of the definition;
- **calculate**, they must determine a number from given facts, figures, or information;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **evaluate**, they must make a judgement based on criteria;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **justify**, they must give reasons to support their suggestions or conclusions;
- **discuss**, they must write about a topic in detail, taking into account different issues or ideas;
- **outline**, they must provide a brief sketch of content - more than naming but not a detailed description;
- **predict**, they must suggest what may happen based on available information;
- **suggest**, they must apply their knowledge and understanding of Environmental Science to a new situation. A number of responses are acceptable: marks will be awarded for any suggestions that are supported by knowledge and understanding of Environmental Science.

Note that this list is not exhaustive.

Marking instructions for each question

Section 1

Question			Expected response	Max mark	Additional guidance
1.	(a)		The mass of carbon dioxide emitted by any specific activity	1	Accept: CO ₂ Do not accept: CO ₂ , CO ² Accept: amount/moles/volume
	(b)	(i)	Irrigation	1	Any other valid response
		(ii)	96 460	1	$371 \times 5 \times 52$
	(c)	(i)	Compensating for emissions of carbon dioxide into the atmosphere with an equivalent reduction in carbon dioxide emissions elsewhere	1	
		(ii)	Plant trees/supporting renewable energy projects/pay to offset flights/support projects that protect biodiversity	1	Any other valid response

Question			Expected response	Max mark	Additional guidance
2.	(a)		Habitat	1	
	(b)		Capture-mark-recapture (1 mark) with appropriate description (1 mark)	2	Any other valid response
	(c)	(i)	8 weeks OR 9 weeks	1	
		(ii)	5:7	1	If 7:5 answer must specify non-shooting:shooting
		(iii)	No shooting when grey partridge are breeding	1	Justification must relate to the diagram
	(d)		C	1	
	(e)	(i) (A)	Carnivore	1	Accept: carnivorous
		(i) (B)	Herbivore	1	Accept: herbivorous
		(ii)	Chick numbers would decrease (1) because pesticide/insecticide/ chemicals would kill off insects/ food supply (1)	2	
		(iii)	Lower profit (1) because of lower yields (1) OR Imperfect produce (1) because of pest/disease damage (1) OR Lower yield (1) so products more expensive for consumers (1) OR More effort for farmers (1) as weed control is more time consuming (1)	2	Any other valid answer

Question			Expected answer(s)	Max mark	Additional guidance
3.	(a)	(i)	Site of special scientific interest	1	
		(ii)	Sliding down sand dunes/picnicking in sand dunes/children digging/walking through sand dunes (Any 1)	1	Any other valid response
		(iii)	More remote so less likely that people will visit/smaller populations in these areas so fewer visitors/weather less conducive to beach visit (Any 1)	1	Any other valid response
	(b)	(i)	Marram grass	1	
		(ii)	25%	1	$\frac{3}{12} \times 100$
		(iii)	<p>Wind speed/salt concentration/tidal effect/sand moisture/nutrients (1 mark)</p> <p>Too much wind damages plants/uproots them (1 mark)</p> <p>OR</p> <p>Too salty causes plants to (lose water and) die (1 mark)</p> <p>OR</p> <p>Tide coming in covers plants with water and kills them (1 mark)</p> <p>OR</p> <p>Sand does not hold water (1 mark)</p> <p>OR</p> <p>Sand does not hold nutrients (1 mark)</p>	2	<p>One mark for abiotic factor, one mark for explanation</p> <p>Any other valid response</p>

Question			Expected response	Max mark	Additional guidance
3.	(b)	(iv)	<p>Wind - anemometer (1 mark), hold up and take reading (1 mark)</p> <p>Salt - refractometer (1 mark) put drop of water on 'window' and take reading/calculate by evaporation (1 mark)</p> <p>Tide -tape measure (1 mark), measure rise and fall of tide (1 mark)</p> <p>Moisture - use a moisture probe (1 mark), insert into sand and take reading/calculate by evaporation (1 mark)</p> <p>Nutrients - use a nutrient probe (1 mark), insert into sand and take reading (1 mark)</p>	2	<p>Response must relate to the factor chosen in (iii)</p> <p>One mark for naming equipment, one mark for brief description</p> <p>Any other valid response</p>
		(v)	<p>Fore dune (1)</p> <p>The only plants at the fore dune are categorised as susceptible (1)</p>	2	
	(c)		<p>Provide paths or boardwalks/provide signs with dos and don'ts/rangers patrolling/ban people from parts of the sand dune/fence areas off (Any 1)</p>	1	Any other valid response

Question		Expected response	Max mark	Additional guidance
4.	(a)	Greenhouse gases absorb reradiated (infrared) radiation (1 mark) allowing the temperature of the Earth to be warm enough for organisms to survive/allow freshwater to be available (1 mark)	2	Accept named greenhouse gas in place of <i>greenhouse gases</i> Any other valid response
	(b)	Hydrosphere/geosphere/biosphere	1	
	(c)	78% Nitrogen 21% Oxygen	1	
	(d)	Any value in the range 400 - 430 ppm	1	Unit must be included

Question		Expected response	Max mark	Additional guidance
5.	(a)	Combustible biomass/a fuel derived from biomass	1	Any other valid response
	(b)	(i) Mass of shells or kernels/volume of water/distance of burning shells or kernels from base of beaker (Any 2)	2	Accept: amount of water Do not accept: amount of shells/kernels Any other valid response
		(ii) In general, kernels transfer more heat energy than shells OR For each nut type, the kernels transfer more energy than the shells.	1	Any other valid response
		(iii) (A) -96.6%/decreases by 96.6%	1	$\left(\frac{2.3-1.17}{1.17}\right) \times 100 = -96.6$ Accept: -97, -96.58, -96.581 Must include negative sign or state 'decreases'
		(iii) (B) Kernels/shells not being fully burnt/incomplete combustion OR Heat/energy being lost to surroundings OR Uneven temperature distribution in water OR Beaker/glass/poor conductor of heat was used to hold the water (Any 2)	2	Responses must be a source of error and not an improvement Any other valid response

Question		Expected response	Max mark	Additional guidance
5.	(c)	<p>Nuts are carbon neutral</p> <p>OR</p> <p>Nuts are a renewable source of energy</p> <p>OR</p> <p>Energy can be produced from a waste product (shells)</p> <p>OR</p> <p>Edible kernels are a foodstuff, so using them reduces food availability/potentially increases food prices</p> <p>OR</p> <p>Provides an alternative income for farmers/nut processors</p> <p>OR</p> <p>Production/transportation of nuts/biofuel releases greenhouse gases</p>	3	Any other valid response

Question			Expected response	Max mark	Additional guidance
6.	(a)		Releases greenhouse gases (methane)/destruction of habitat to clear space for site/vermin/leaching eyesore/smells (Any 1)	1	Any other valid response
	(b)	(i)	Different coloured bins for different items/reducing the frequency of bin collections	1	Any other valid response
		(ii) (A)	The initiatives have been successful (1 mark) because overall the total amount of waste going to landfill has decreased (over the 12-year period) (1 mark)	2	1 mark for stating outcome 1 mark for explanation
		(ii) (B)	1.25	1	Accept 1.3, 1.251
	(c)	(i)	Increased population/societal demands/increased consumption	1	Any other valid response
		(ii)	Global citizenship is an awareness of the world as a global community and recognition of the <u>rights and responsibilities</u> of citizens within it	1	Response must refer to global/world

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	EBAD	1	
		(ii)	<u>Similarity</u> Both feed on dead organic matter (1 mark) <u>Difference</u> Detritivores are animals, decomposers are bacteria and fungi OR Decomposers feed at microscopic level, detritivores don't (1 mark)	2	Difference must be a comparative statement/include reference to both organisms
	(b)	(i)	(Root) nodules	1	Do not accept: roots
		(ii)	Nitrate	1	

Question			Expected response	Max mark	Additional guidance
8.	(a)		Transpiration	1	Do not accept: evapotranspiration
	(b)		The Sun	1	
	(c)		Water infiltrates/infiltration (1 mark), which is the physical movement of water through soil (relative to the soil's porosity and permeability) (1 mark) Water percolates/percolation (1 mark), which is the movement of water through the soil by <u>gravity and capillary forces</u> (1 mark)	4	Any other valid response
	(d)	(i)	Steep gradient/high precipitation/narrow, deep valley/impermeable geology/proximity to National Grid/current land use (Any 2)	2	No mark awarded for placement of H but reasons given must be relevant to selected location
		(ii)	Tidal/wave	1	

Section 2

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Formed from the remains of small animals/plants/plankton that died and fell to the seafloor millions of years ago (1 mark) Compression and heating of these remains within the Earth's crust (forms oil) (1 mark)	2	1 mark for biological formation, 1 mark for geological formation Biological formation must include the components, location, and time scale Geological formation must include reference to compression/pressure and heat
		(ii)	Porous rocks can hold fluids (such as crude oil)		
	(b)	(i)	To reprocess materials into new and useful products	1	Any other valid response
		(ii)	The axis/axes of the graph has/have suitable scales (1 mark) The axes of the graph have suitable labels AND units (1 mark) Accurate plotting of bars (1 mark)	3	
	(c)		Helicopter would not be able to reach platforms and then return without refuelling (1 mark) OR Weather too extreme/too dangerous on many days of the year to allow the helicopter to fly (1 mark) OR Would cost £500 just to transport one visitor to a remote platform/£1000 for a return visit (1 mark) OR Transporting customers, staff and provisions this far offshore/to a remote site would be very expensive (1 mark) OR Attracting hotel staff to a barren and dangerous workplace would be challenging (1 mark)	2	Any other valid response Any two

Question			Expected response	Max mark	Additional guidance
9.	(d)	(i)	35	1	140 oil wells ÷ 4 platforms
		(ii)	<p><u>Environmental</u> Creation of quarry clears land/destroys habitat (1 mark)</p> <p>OR</p> <p>Quarrying/transport of materials or limestone releases greenhouse gases (1 mark)</p> <p>OR</p> <p>Limestone dust will settle on farmer's fields changing the pH of soil (1 mark)</p> <p><u>Social</u> Lorries regularly passing through settlements causing congestion (1 mark)</p> <p>OR</p> <p>Job creation (1 mark)</p> <p>OR</p> <p>Limestone dust will have a detrimental impact on people with breathing conditions (1 mark)</p>	2	Any other valid answer
	(e)	(i)	0.8	2	$A = 3.14 \times 0.5^2$ (1 mark) 0.785 km ² (1 mark) OR $3.14 \times 500^2 = 785\,000\text{ m}^2$ (1 mark) 0.785 km ² (1 mark) Accept: 0.79/0.785
		(ii)	Trawling (1 mark) involves pulling a large net behind the boat(s) (1 mark)	2	1 mark for method, 1 mark for description of method. Where an incorrect method has been identified, candidate may still be awarded 1 mark for correctly describing <u>their named</u> method As cod live above the seabed, dredging would not be used. However, candidates should not be penalised for giving this method.

Question		Expected response	Max mark	Additional guidance
9.	(f)	<p>Remove legs The oil company has made lots of money exploiting nature and therefore has a responsibility to return the habitat back to its natural state (1 mark)</p> <p>OR The oil company is bound by law to clean up the habitat (1 mark)</p> <p>OR If the legs are removed, fishing boats may be able to operate here again (1 mark)</p> <p>OR If they leave the concrete support legs, they will disintegrate due to the harsh wave/weather conditions and concrete will sink to the sea bed (1 mark)</p> <p>OR Concrete, if left behind, could pollute the ecosystem/enter the food web (1 mark)</p> <p>OR Should be removed to prevent ships colliding with the legs, if left in place (1 mark)</p> <p>OR If legs are not removed, fishing boats may damage their nets if they attempt to fish here (1 mark)</p>	4	Any other valid response

Question		Expected response	Max mark	Additional guidance
9.	(f)	<p>Leave the legs Mechanical removal would risk the lives of workers (1 mark)</p> <p>OR Removal would be a very expensive option/the expense of removal will fall upon the British tax payer (1 mark)</p> <p>OR Explosive removal will disturb/kill marine species (1 mark)</p> <p>OR Technology to remove the platform legs has not been tested and therefore may pose risk to environment/workers (1 mark)</p> <p>OR The harsh marine environment/strong winds/cold seas would risk workers lives if attempts were made to remove these platform legs (1 mark)</p> <p>OR Provides new habitat for marine life, increasing biodiversity (1 mark)</p> <p>OR Limits fishing in the area, reducing disturbance to aquatic life/increases biodiversity (1 mark)</p>		

Section 3

Question	Expected response	Max mark	Additional guidance
<p>10. A</p>	<p>The sustainable use of water allows using water for today’s needs without compromising the needs of future generations (1 mark)</p> <p>Home Take shorter showers/turn off the water when brushing your teeth/use your dishwasher and washing machine for full loads only/water your lawn only when it needs it/using hot tubs or paddling pools less often (Any 3)</p> <p>Schools Fix Leaking taps/automatic flush of toilets/install low flush toilets/install water meters/educate pupils on water conservation/use low-flow appliances in kitchen (Any 3)</p> <p>Industry Metered water supplies/harvested water/fix water leaks/replacement of equipment/alter processes to minimise water use/reuse water (Any 3)</p>	<p>7</p>	<p>Candidates cannot gain multiple marks for discussing the same methods in different sectors</p> <p>Max 3 marks per sector</p> <p>Any other valid response</p>

Question	Expected response	Max mark	Additional guidance
10. B	<p><u>Generation</u> (Wind power) is sustainable because it is a renewable resource (1 mark)</p> <p>Wind blows onto angled blades causing the turbine/rotors to spin (1 mark) this causes part of the generator to spin (1 mark)</p> <p>Kinetic energy is converted to electrical energy (1 mark) that can be stored in batteries/supplied to the National Grid (1 mark)</p> <p><u>Environment</u> The generation of electricity does not release greenhouse gases (1 mark) and therefore can reduce impact on climate change/global warming (1 mark)</p> <p>Building of wind turbines/farm destroys or disturbs habitats/nesting sites (1 mark)</p> <p>Can affect migration patterns of birds (1 mark)</p> <p>Noise produced by wind turbines can disturb organisms (1 mark)</p> <p><u>Economy</u> High initial/capital cost to build turbines/farm (1 mark)</p> <p>Potential to sell energy back to National grid (1 mark)</p> <p>Building of turbines can generate additional income for suppliers/tax (1 mark)</p> <p>Farmers can sell/rent land to companies building wind farms (1 mark)</p> <p>Increase in revenue from community eg builders/visitors spending in shops (1 mark)</p>	7	<p>Maximum 3 marks for generation Maximum 3 marks for environment Maximum 3 marks for economy</p> <p>Any other valid answer</p> <p>Accept: Information from annotated diagrams</p>

Question		Expected response	Max mark	Additional guidance
11 A		<p>Term <i>food web</i> stated (1 mark)</p> <p>Food webs are made up of food chains (1 mark)</p> <p>The Sun is the source of energy of the food web (1 mark)</p> <p>Photosynthesis allows energy to enter the food web (1 mark) and is carried out by producers/(usually) green plants (1 mark)</p> <p>Photosynthesis converts light energy to chemical energy (1 mark)</p> <p>Arrows indicate direction of energy flow (1 mark)</p> <p>Energy flows from producer to primary consumer/primary consumer to secondary consumer/secondary consumer to tertiary consumer (1 mark)</p> <p>Energy is lost through heat/movement/undigested material (1 mark)</p> <p>10% of energy is passed on to the next stage/90% of energy is lost at each stage (1 mark)</p> <p>Woodlouse is a detritivore (1 mark) that gets its energy/feeds on dead organic matter (1 mark)</p>	7	<p>Do not accept: <i>food chain</i> for the type of diagram.</p> <p>Any 7</p> <p>Any other valid answer</p>

Question		Expected response	Max mark	Additional guidance
11. B		<p>Photosynthesis is carried out by producers/(usually) green plants (1 mark)</p> <p>Chlorophyll AND light energy required (1 mark)</p> <p>carbon + water → glucose + oxygen dioxide (1 mark)</p> <p>Oxygen produced in photosynthesis needed for animal respiration (1 mark)</p> <p>Glucose/starch produced through photosynthesis needed for animal feeding/nutrition (1 mark)</p> <p>Glucose/starch is needed for respiration (1 mark)</p> <p>Respiration carried out by animals (and plants) (1 mark)</p> <p>glucose + oxygen → carbon + water dioxide (1 mark)</p> <p>Carbon dioxide produced in respiration needed for photosynthesis (1 mark)</p> <p>Water produced in respiration needed for photosynthesis (1 mark)</p>	7	<p>Any 7</p> <p>Any other valid answer</p> <p>Accept: sugar/starch in place of glucose for word equation Accept chemical equation</p> <p>Do not accept: light/chlorophyll as reactants in the equation.</p> <p>Accept chemical equation</p>

[END OF MARKING INSTRUCTIONS]