National Qualifications 2024

2024 Environmental Science

National 5

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

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, CO_2 or H_2O) 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 CO^2), 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)	(i)	Purple saxifrage/Arctic willow	**1**	
		(ii)	Goose eats purple saxifrage but the eider duck does not. **OR** The goose has another food source. **OR** Only the goose eats purple saxifrage.	**1**	Must have comparison
		(iii)	(It lives in the Arctic), consumes the purple saxifrage **and** Arctic willow **AND** is consumed by the wolf	**1**	
		(iv)	Movement/undigested material	**1**	Do not accept: respiration/growth
	(b)	(i)	Paw/foot/bottom of foot/toes	**1**	
		(ii)	49 °C	**1**	Must include unit
	(c)	(i)	(Fur) maintains the internal temperature	**1**	Do not accept: reference to insulation alone
		(ii)	Adaptation	**1**	
	(d)	(i)	Wolf	**1**	
		(ii)	5	**1**	
		(iii)	As the average length of fur increases so does the relative insulative value/As the average length of fur decreases so does the relative insulative value.	**1**	Must have correct cause and effect
		(iv)	Temperature of polar bear will decrease (**1 mark**) Wet fur has a lower relative insulative value (**1 mark**)	**2**	Accept: it gets colder

Question			Expected response	Max mark	Additional guidance
2.	(a)		TRUE FALSE – Bacteria FALSE – Nitrogen fixation	**3**	1 mark for each correct answer
	(b)		They feed on/eat consumers/other animals.	**1**	Must refer to feeding/eating AND consumers/animals Do not accept: feeding on organisms Any mention of direct feeding on plants = 0 marks
	(c)		Decomposer/detritivore	**1**	

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	Closer to national grid **(1 mark)** therefore lower construction costs **(1 mark)** **OR** More exposed site **(1 mark)** therefore more wind for energy generation **(1 mark)** **OR** Deforestation not necessary **(1 mark)** therefore fewer habitats destroyed/ lower impact on biodiversity/public image **(1 mark)**	**2**	1 mark for reason 1 mark for explanation Any other valid response
		(ii)	Advantage – meeting high demand for energy/reduced cost of transmission lines/reduced power loss/easier access to employees/less infrastructure required Disadvantage – visual pollution/ noise pollution	**2**	Must relate to areas of high population density Any other valid response
	(b)	(i)	Kinetic (energy)	**1**	Do not accept: movement (energy)
		(ii)	Angle of fan/power of fan/angle of blades/number of blades/shape of blades/material of blades	**2**	Any two Any other valid response Do not accept: wind speed
		(iii) (A)	0.94 W	**1**	Unit must be included Accept: 0.9 W, 0.938 W, 0.9381 W
		(iii) (B)	As the distance (of the fan from the turbine) increases, the power (generated) decreases **OR** As the distance (of the fan from the turbine) decreases, the power (generated) increases	**1**	Must have correct cause and effect The conclusion must relate to the aim given in the stem of the question
		(iv)	They would repeat the experiment **(1 mark)** and achieve the same/similar results each time **(1 mark)**	**2**	Ignore 'and average' Accept: reject dissimilar/anomalous results

Question			Expected response	Max mark	Additional guidance
4.	(a)		a (naturally occurring solid) material from which a metal/(valuable) mineral can be extracted (profitably)	**1**	Must refer to a metal/mineral in response
	(b)		40 800 (tonnes)	**1**	$(68\times1000)\times\frac{60}{100}=40\,800$
	(c)	(i)	Limestone Coke	**2**	Accept: coal/carbon in place of coke X/Y order does not matter
		(ii)	Pig (iron)	**1**	
		(iii)	Would need to be removed by vehicles that release greenhouse gases/habitats destroyed to clear room for slag heap/toxic to organisms/is non-biodegrable	**1**	Any 1 Any other valid response
	(d)	(i)	The mass of carbon dioxide emitted by any specific activity	**1**	Do not accept: 'carbon' on its own
		(ii)	Electricity can be generated from renewables **(1 mark)** therefore less greenhouse gases/CO_2 will be emitted **(1 mark)** **OR** Requires less coal/fossil fuels **(1 mark)** Therefore fewer habitats destroyed when open-cast mined. **(1 mark)**	**2**	Any other valid response

Question			Expected response	Max mark	Additional guidance
5.	(a)		Wastewater	**1**	
	(b)	(i)	34.1(%)	**1**	16.7 + 1.7 + 15.7 = 34.1
		(ii)	Take showers instead of baths/low-flush toilets/turn the water off while brushing teeth/collect rainwater for watering plants	**2**	Any 2 Any other valid response

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	Can cause damage to the environment/the economy/our health/the way we live	**1**	Any other valid response
		(ii)	NatureScot/NS	**1**	Do not accept: Scottish Natural Heritage/SNH
	(b)	(i)	Aesthetic value/ornamental garden plant	**1**	Any other valid response
		(ii)	Large leaves block sunlight from getting to other plants **(1 mark)** Plants cannot photosynthesise/make food (, and die) **(1 mark)**	**2**	Response must refer to the information provided Any other valid response
	(c)		Both axes labelled correctly, with correct units **(1 mark)** Suitable scale on both axes **(1 mark)** Accurate plotting of data points, with line of best fit **(1 mark)**	**3**	Do not accept: data points joined dot to dot
	(d)	(i)	Increase the land available to the grazing sheep/reduce the time the sheep are grazing the land/ supplementary feeding	**1**	Any other valid response
		(ii)	(It) decreases	**1**	

Question			Expected response	Max mark	Additional guidance
7.	(a)		Increase in societal demands/ affluence/globalisation of supply chains/excess packaging	**1**	Any 1 Any other valid response
	(b)	(i)	To reprocess/turn material into new (and useful) products	**1**	Reference to reusing negates mark
		(ii)	Reusing/it does not require as much energy (as recycling) **OR** Reusing/it releases less greenhouse gases (than recycling)	**1**	Any other valid response
		(iii)	People may be less likely to throw their bottle caps away **(1 mark)** meaning less money spent on refuse collectors **(1 mark)** **OR** They attract tourists **(1 mark)** who spend money in the local area **(1 mark)** **OR** Lead to less litter **(1 mark)** therefore attracting more tourists to the city (**1 mark**)	**2**	1 mark for benefit 1 mark for explanation Any other valid response
	(c)		Providing colour coded bins for recycling/roadside collections/less frequent collections/invest in waste education/smaller general household waste bins	**2**	Any 2 Any other valid response

Question			Expected response	Max mark	Additional guidance
8.	(a)		Most abundant stocks/largest ocean area/largest fishing fleets/ high demand markets	**2**	Any 2 Any other valid response
	(b)	(i)	Nets are indiscriminate/result in bycatch/result in protected species being caught **(1 mark)** therefore kills non-target species **(1 mark)** **OR** Net fishing can result in going over quota **(1 mark)** causing wild populations to decrease **(1 mark)** **OR** nets can break free **(1 mark)** which can injure/kill non-target species **(1 mark)**	**2**	Award 1 mark only for converse arguments eg net indiscriminate and hook and line discriminate. Any other valid response
		(ii)	Some areas may have experienced overfishing/have low stocks/ concerns about (lost) lines endangering other species/catch too low/unable to meet demand	**1**	Any other valid response
		(iii)	Using larger mesh size **(1 mark)** allows juveniles to escape and mature to breeding age **(1 mark)** **OR** Using different net shapes **(1 mark)** that only catch target species/allow bycatch to escape **(1 mark)** **OR** Limiting the days at sea/fishing seasons **(1 mark)** allows fish time to breed/repopulate **(1 mark)**	**2**	1 mark for identifying sustainable fishing method 1 mark for explanation of how method contributes to stock recovering Any other valid response Do not accept: no fishing area

Section 2

Question			Expected response	Max mark	Additional guidance
9.	(a)		habitat loss/reduction in biodiversity/changes in species distribution/rising sea levels leading to loss of ecosystems	**1**	Any 1 Any other valid response
	(b)		Anemometer	**1**	
	(c)		Southwest (SW)	**1**	
	(d)		Furniture/house-building material/crafts/paper	**1**	Any 1 Any other valid response
	(e)	(i)	The relationship/balance between social, economic, and environmental issues/factors.	**1**	All 3 factors must be mentioned. Do not accept: the definition of sustainable development
		(ii)	Economic Development: C/D/E Renewable Energy: C Social Inclusion: A/B	**2**	All 3 correct – 2 marks, 2 correct – 1 mark, 0/1 correct – 0 marks Each statement may only be used in one category
	(f)	(i)	Name of equipment – soil moisture meter/pH probe or paper/nutrient probe or dipstick **(1 mark)** Description of use: soil moisture: wipe probe, put into soil, (leave for a time,) take reading **(1 mark)** **OR** pH: wipe probe, put into soil, (leave for a time,) take reading/moisten the pH paper, press against soil, and compare colour with chart/take soil sample, mix with water and filter, test with pH paper/universal indicator and compare colour with chart **(1 mark)** **OR** Nutrient: wipe probe, put into soil, (leave for a time,) take reading/use dipstick on soil and compare reading to scale **(1 mark)**	**2**	1 mark – piece of equipment. 1 mark – method. Any other valid response

Question			Expected response	Max mark	Additional guidance
9.	(f)	(ii)	Meters/probes: probe not wiped/probe not left in soil long enough before taking reading/meter may not be calibrated pH test/dipstick: Difficulty comparing colours to chart	**1**	Any other valid response Do not accept: reference to faulty equipment/ inaccurate equipment (on its own)
		(iii)	Hazel, Oak, White spruce	**2**	3 correct – 2 marks 2 correct – 1 mark 1 or fewer correct – 0 marks If more than 3 species identified, incorrect answers negate
	(g)	(i)	£4500	**1**	50 × 90 = £4500 Must have correct unit
		(ii)	167(%)	**1**	$\left(\frac{50}{30}\right)\times 100=167\%$ Accept: 166.7%
	(h)		Native mixed woodland **(1 mark)** More habitats in nmw compared to nncw/greater variety of food in nmw/more nesting sites in nmw. **(1 mark)**	**2**	1 mark for identification of native mixed woodland. 1 mark for suitable explanation. Any other valid response

Question			Expected response	Max mark	Additional guidance
9.	(i)		**Native mixed woodland:** • Planting native species is less likely to have a negative impact on the environment/other species. • Native mixed woodlands can provide a greater range of food/ shelter/nesting sites to increase biodiversity/support populations. • Native mixed woodlands may allow light to better penetrate the canopies and therefore more vegetation/plant species/greater biodiversity. • Woodland can lower CO_2 levels long term, reducing the impact of climate change. • Can be used to produce fuelwood to create renewable/ sustainable energy/reduce dependence on fossil fuels. • Can provide better educational opportunities for schools and other users. • Soil moisture of the area better supports native species. **Non-native conifer woodland:** • Faster growing so would establish the woodland area more quickly. • Conifer woodland can lower CO_2 levels more quickly, reducing the impact of climate change. • Forestry/timber production can create more jobs in the local area. • Conifer woodlands can add aesthetic value (particularly in wintertime). • Christmas trees and other products can be sold to boost economy. • Can be used to produce fuelwood to create renewable/ sustainable energy/reduce dependence on fossil fuels. • Can provide educational opportunities for schools and other users.	**4**	Any 4. Any other valid response Marks allocated must be in support of candidate's decision

Section 3

Question			Expected response	Max mark	Additional guidance
10.	**A**	(a)	Terrestrial species identified eg cotton **(1 mark)** Cotton: Produces cotton (fibres) that can be used to make clothes/ bedding/cosmetics **(1 mark)** Sugar cane: used for biofuels/animal feed/sugar production/alcohol **(1 mark)**	**7**	Max 5 marks for discussing terrestrial species Max 1 mark for identifying species Max 2 marks for uses/products for each plant species identified The raw material and product/use must be appropriate to the species to be awarded the mark Max 1 mark for identifying a species as a food Candidates should not be double credited for giving two identical products/uses eg "for food". This includes responses given in part (b) Any other valid response
		(b)	Aquatic species identified eg seaweed **(1 mark)** Seaweed: contain chemicals that make them useful for cosmetics/ agriculture/food additives **(1 mark)** Rice: used for food/source of starch for alcohol/fertiliser/packaging **(1 mark)**	**7**	Max 5 marks for discussing aquatic species Max 1 mark for identifying species Max 2 marks for uses/products for each plant species identified The raw material and final product/ use must be appropriate to the species to be awarded the mark Max 1 mark for identifying a species as a food Candidates should not be double credited for giving two identical products/uses eg "for food". This includes responses given in part (a) Award a maximum of 2 marks for discussion of sustainability of products Any other valid response

Question			Expected response	Max mark	Additional guidance
10.	**B**	(a)	Terrestrial species identified eg bees **(1 mark)** Bees: produce (bees)wax that can be used in candles or cosmetics **(1 mark)** honey that can be used for food/ medicines/alcohol **(1 mark)** Cow: Leather for clothes/shoes/bags **(1 mark)** Milk is used for making dairy products **(1 mark)**	**7**	Max 5 marks for discussing terrestrial species. Max 1 mark for identifying species. Max 2 marks for uses/products for each animal species identified. The raw material and product/use must be appropriate to the species to be awarded the mark. Max 1 mark for identifying a species as a food. Any other valid response Candidates should not be double credited for giving two identical products eg "clothes". This includes responses given in part (b). Any other valid response.
		(b)	Aquatic species identified eg cod **(1 mark)** Cod: used for food/produce oils that can be used to make cod liver oil tablets **(1 mark)** Oysters: used for food/produce pearls that can be used to make jewellery/used in building materials **(1 mark)**	**7**	Max 5 marks for discussing aquatic species. Max 1 mark for identifying species. Max 2 marks for uses/products for each animal species identified. The raw material and product/use must be appropriate to the species to be awarded the mark. Max 1 mark for identifying a species as a food. Candidates should not be double credited for giving two identical products eg "food". This includes responses given in part (a). Award a maximum of 2 marks for discussion of sustainability of products. Any other valid response

Question			Expected response	Max mark	Additional guidance
11.	**A**		Climate change is a large-scale, long-term shift in Earth's weather patterns or average temperatures (**1 mark**) *Social* • Extreme weather conditions/ specific example can result in death/injury • Drought/lack of water can kill people/affect health • Destruction of crop results in famine/food insecurity • Jobs will be lost due to lack of tourism/destruction or closure of workplaces *Economic* • Damage to buildings/ infrastructure that costs money to be repaired • Loss of agricultural land due to flooding meaning crops cannot be sold/increased food prices • Lack of tourism will bring less money to country • Damage to places of work means products can't be made/sold/ exported • Costs of mitigation such as building sea/flood defences	**7**	Maximum of 4 marks for each category Candidates should not be double credited for giving two identical impacts eg "death" Any other valid response

Question			Expected response	Max mark	Additional guidance
11.	**B**		Max 1 mark for an example of a greenhouse gas eg carbon dioxide/ methane/nitrous oxides *Transport* • Switch to electric/hydrogen powered cars/public transport • Use biofuels as these are carbon neutral • Phase out petrol/diesel cars • Introduce low emissions zones/ congestion charges • Build/use cycle paths or walkways to reduce use of vehicles • Educate the public on how to reduce greenhouse gas emissions • Introduce legislation to reduce greenhouse gas emissions *Agricultural* • Farm insects/more chickens instead of cattle • Add chemicals to feed that reduces methane emissions from livestock • Do not use/reduce use of agrochemicals • Plant leguminous plants amongst crops (instead of using fertilisers) • Use less machinery	**7**	Maximum of 4 marks for each category Candidates cannot gain multiple marks for discussing the same methods in different sectors Any other valid response

[END OF MARKING INSTRUCTIONS]