General marking principles for National 5 Environmental Science

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

(a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific 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 must seek guidance from your team leader.

(d) There are no half marks awarded.

(e) Where a candidate makes an error at an early stage in a multi-stage calculation, credit should normally be given for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.

(f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including unit) on its own.

(g) Where a wrong answer (for which no credit has been given) is carried forward to another step, credit will be given provided the end result is used correctly.

Marking instructions and commentaries

Question			Expected Answer(s) *and additional guidance*	Max Mark	Commentaries
Section 1					
1.	(a)	(i)	The Sun	**1**	Example 1: Is not an acceptable response. **0 marks** awarded. Example 2: Is not an acceptable response. At National 5 it is expected that candidates will be familiar with correct terms. **0 marks** awarded.
		(ii)	Arctic hare *Do not accept: hare (on its own)*	**1**	Example: Hare on its own is not acceptable, it must be arctic hare. **0 marks** awarded.
		(iii)	Energy moving from (arctic) hare and/or snowy owl to (arctic) fox, (**1 mark**) and from (arctic) fox to (arctic) wolf. (**1 mark**) *Accept: arrows indicate direction of energy flow (**1 mark**)* *For full marks, there must be comment on energy movement to and from.*	**2**	Example 1: No discussion of movement of energy. **0 marks** awarded. Total marks awarded: **0** Example 2: No discussion of movement of energy. **0 marks** awarded. Total marks awarded: **0** Example 3: **1 mark** awarded for arrows indicating the direction of energy flow. Total marks awarded: **1**

		(iv)	Snowy owl eats stoat but rough-legged hawk doesn't. *Accept:* *Snowy owl has an alternative food source.* *Snowy owl is nocturnal but the rough-legged hawk is not.* *The two have different niches.*	**1**	Example 1: Discussion of the snowy owl's diet is insufficient for the mark to be awarded. **0 marks** awarded. Example 2: **1 mark** awarded for snowy owl having more food sources than rough-legged hawk.
	(b)	(i)	Paint mark / clipping hair / tag / other valid response	**1**	Example 1: Not a method usually used for stoat but is a valid method used for other species. Candidates are not expected to be familiar with stoats or specific methods relating to them. **1 mark** awarded. Example 2: **1 mark** awarded for a valid method.
		(ii)	36 $12 \times 15 \div 5$	**1**	Candidates had no difficulties with this question in the evidence sampled.
	(c)	(i)	White gives it camouflage during snowy winters Or Brown gives it camouflage when snow is not present Or Camouflage Or Helps it avoid predation Or other valid response	**1**	Example: **1 mark** awarded for a response that covers both colour aspects.
		(ii)	Adaptation	**1**	Example: **1 mark** awarded despite the term stated 'adaption' not being quite correct. In general, the mark will be awarded where the term is recognisable and not likely to be confused with another similar sounding scientific term.

		(iii)	Numbers decrease (**1 mark**) as it would be less camouflaged (**1 mark**) Or other valid response. *Accept:* *Less likely to go white, (**1 mark**)* *so it would still be camouflaged in the non-snowy environment (**1 mark**)* *Or* *Less likely to go white, (**1 mark**)* *so it wouldn't be camouflaged when it does snow (**1 mark**)*	**2**	Example 1: **1 mark** awarded for impact on stoat population. **1 mark** awarded for explanation. Total marks awarded: **2** Example 2: A reduction in snowfall will not prevent the stoat from hunting or cause it to get too cold. Total marks awarded: **0** Example 3: **1 mark** awarded for impact on the stoat population. **1 mark** awarded for explanation. Total marks awarded: **2**
2.	(a)		Dysentery / cholera / salmonellosis *Any one.*	**1**	Example: While malaria is a disease that can be spread through water supplies (if female Anopheles mosquitos carrying malaria plasmodium are present), the question directs candidates to use information from the passage. **0 marks** awarded.
	(b)		Fuel may not be available locally Or Because of deforestation Or Lack of money to buy fuel Or To save money Or other valid response. *Any two valid responses for 1 mark each.*	**2**	Example 1: The single word responses given by this candidate requires the marker to second-guess what they mean. 'Cost' equates to lack of money (to buy fuel). **1 mark** awarded. 'Transportation' is insufficient. **0 marks** awarded. Total marks awarded: **1** Example 2: **1 mark** awarded for lack of local fuel source. **1 mark** awarded for lack of money. Total marks awarded: **2**

	(c)	(i)	105 mins / 1 hour 45 mins / 1.75 hours (5 people × 3 litres × 7 days) = 105 litres (**1 mark**) (105 × 1 min/l) = 105 mins (**1 mark**) *Must include units, otherwise maximum of 1 mark.*	**2**	Example 1: The calculation is incomplete. **1 mark** awarded for calculation of litres required. **0 marks** for time required to produce that volume. Total marks awarded: **1** Example 2: No working is shown, and no units are included. It is not clear whether the 105 refers to volume or time but the first stage of the calculation must have been completed to arrive at that value. **1 mark** awarded. Total marks awarded: **1**
		(ii)	Use of technology allows present generation to access/use resources without compromising the needs of future generations. Or other valid response. *Response must talk about not compromising the needs of future generations.*	**1**	The examples all refer to aspects of sustainability (environmental, economic, social), rather than sustainable development. **0 marks** awarded. Candidates must be aware of the difference between sustainability and sustainable development.
	(d)		Scottish Environmental Protection Agency/SEPA *Accept Scottish Water.*	**1**	Example: Candidates should be familiar with the full name of SEPA. 'Action' in place of 'agency' is not acceptable. **0 marks** awarded.
	(e)		Shower instead of bath Or Don't leave tap running when cleaning teeth Or Mend dripping taps Or Use 'grey' water for garden irrigation Or other valid response.	**1**	Example: The examples given typically relate to saving energy, but both will also save water if the equipment is only run when full. **1 mark** awarded for a valid response.

3.	(a)		A carbon footprint is a measure of the mass of carbon dioxide emitted by a specific activity. *Accept:* *Emitted by a person/pet in place of specific activity*	**1**	Example 1: Refers to carbon dioxide produced by living organisms. **1 mark** awarded. Example 2: Carbon dioxide from faeces is considered to be carbon neutral, so does not contribute to the carbon footprint. Other gases (methane, nitrous oxide) are emitted but do not contribute to the carbon footprint (as the definition stands). **0 marks** awarded. Example 3: This would be a valid response if the chemical formula for carbon dioxide was correct, ie with a subscript 2. **0 marks** awarded.
	(b)	(i)	Completing column headings, with units (**1 mark**) Correct order as follows: (**1 mark**) goldfish, budgie, hamster, cat Correct values for each pet (**1 mark**) *Units can be in the body of the table instead of in the column heading.*	**3**	Example 1: **1 mark** for correct column headings. The breeds are not arranged from smallest to largest. **0 marks** awarded. **1 mark** for correct values for each breed. Total marks awarded: **2** Example 2: The unit is missing from the column headings. **0 marks** awarded. The breeds are arranged from smallest to largest (using values in the information provided). **1 mark** awarded. The value for goldfish is incorrect: should be 0.00034 gha). **0 marks** awarded. Total marks awarded: **1**
		(ii)	0.84 (gha) 280 × 0.003 = 0.84 gha	**1**	Candidates had no difficulties with this question in the evidence sampled.

4.	(a)		Pans / gates / furniture / nails / other valid response	**1**	Example 1: 'buildings' is not sufficient: what aspect of buildings? **0 marks** awarded. Example 2: The 'Forth rail bridge' is a valid example of an iron-containing structure. **1 mark** awarded.
	(b)	(i)	Formed in sea water as a result of oxygen release by photosynthesising organisms. (**1 mark**) The oxygen combines with dissolved iron in the ocean to form iron oxide. (**1 mark**) Or other valid response.	**2**	Example 1: Iron ore does not form through compression. **0 marks** awarded. Total marks awarded: **0** Example 2: The candidate shows a basic understanding of the process but specifics (such as oxygen) are missed. **1 mark** awarded. Total marks awarded: **1**
		(ii)	Blast furnace	**1**	Example: The candidate describes use of a blast furnace, rather than naming it. **0 marks** awarded.
	(c)		570 (tonnes) 95% of 300 tonnes = 285 tonnes × 2 kelpies = 570 tonnes	**1**	Example 1: The calculated value is for one kelpie only. **0 marks** awarded. Example 2: There is an error in the initial stage of the calculation, resulting in the result being 100 times too high. **0 marks** awarded.
	(d)	(i)	3 (metres) $\frac{1}{10}$ of 30 metres	**1**	Candidates had no difficulties with this question in the evidence sampled.

		(ii)	Burning fossil fuels to transport models Or Traffic congestion caused by lorry Or Emissions of greenhouse gases Or other valid response	**1**	Example 1: Cars would not be used to transport the kelpies. **0 marks** awarded. Example 2: Although the candidate gives valid impacts associated with transportation of large loads, they discuss movement of the full-size kelpies rather than the scale models. **0 marks** awarded, as part of the statement is incorrect.
5.	(a)		(An SSSI is designated as of particular interest because of its:) fauna/flora/geology/ geomorphology/other valid response	**1**	Example 1: Research potential is not a valid reason for SSSI designation. **0 marks** awarded. Example 2: Valid reference to geology and species (fauna/flora). **1 mark** awarded.
	(b)	(i)	For example: Stakeholders: anglers/watersport enthusiasts; mountain bikers/walkers; conservationists/hunters Reasons for conflict: lines tangle with boards; going too fast/blocking path; birds scared away; or other valid response. *1 mark for each valid reason*	**2**	Example 1: (Anglers vs watersport enthusiasts) 'Disturbing fish' is not sufficiently specific: both anglers and watersports enthusiasts could be disturbing fish. **1 mark** awarded for disturbance of fishing party (by watersports enthusiasts). Total marks awarded: **1** Example 2: (Campers vs environmentalists) Two valid reasons given. Total marks awarded: **2**

		(ii)	Signage / zoning (eg cycle routes) / code of conduct / rangers monitoring / other valid response *1 mark for each valid action.* *Must be linked to (b)(i)* *Accept role of National Park if an understanding of what it does is there.*	**2**	Example 1: (Hunters vs environmentalists) **1 mark** awarded for zoning. Setting up species-specific traps would not appease environmentalists, and does not equate to hunting. Total marks awarded: **1** Example 2: (Anglers and watersport enthusiasts) **1 mark** for time allocations for different stakeholders. Total marks awarded: **1** Example 3: (Campers vs environmentalists) **1 mark** for legislation/code of conduct. Total marks awarded: **1**
	(c)		9.3 1.64 – 1.50 = 0.14 *(***1 mark***)* $\frac{0.14}{1.50} \times 100$ (**1 mark**) *Accept 9, 9.33, 9.333*	**2**	Example 1: The candidate has extracted the correct values from the graph but then confused them and given an incorrect final answer. **0 marks** awarded. Total marks awarded: **0** Example 2: The working shows that the candidate has extracted the correct values from the graph, and has correctly calculated 0.14. **1 mark** awarded. 1.64 rather than 1.50 has then been used as the denominator, resulting in an incorrect outcome of 8.5. The candidate has rounded the value to 9 which would be an acceptable rounding for 9.33. However, the candidate has clearly selected an incorrect value to use in the calculation. **0 marks** awarded. Total marks awarded: **1**

	(d)	(i)	Pine marten / red grouse	**1**	Candidates had no difficulties with this question in the evidence sampled.
		(ii)	For: (**1 mark**) provides employment/income; red deer are not endangered; benefit for forestry; or other valid response Against: (**1 mark**) land managed for hunting limits forest growth/biodiversity; shooting interferes with walkers/ birdwatchers; personal beliefs/ethics; or other valid response	**2**	Example 1: **1 mark** awarded for a valid reason for hunting. **1 mark** awarded for a valid reason against. Total marks awarded: **2** Example 2: The candidate has not given clear reasons for or against hunting. Total marks awarded: **0**
		(iii)	Captive breeding / legislation / habitat improvements / nest cameras / control of predators / disease control / hunting ban / other valid response	**1**	Example 1: Littering is on the increase, not decrease. **0 marks** awarded. Example 2: **1 mark** awarded for encouragement (rather than banning).
		(iv)	Native forest will consist of trees which have existed in Scotland since the ice age, such as Scots pine, rowan, birch, whitebeam etc. (**1 mark**) Native forest will tend to have an open canopy. Plantations tend to be dense, closed canopy and often monoculture. (**1 mark)** Plantations are planted and maintained for commercial or other human needs. (**1 mark**) Any other valid response. *1 mark for each explained difference.*	**2**	The key difference between the two types of forestry is that native forest evolves over a much longer timescale and regenerates naturally, while plantations are planted and managed for a specific purpose. Example 1: **1 mark** awarded for explanation for native forestry. Plantation forestry can be managed for both native and non-native species. **0 marks** awarded. Total marks awarded: **1** Example 2: Most forests are managed in some way, including native forestry. **1 mark** awarded for explanation of plantation. Total marks awarded: **1**

		(v)	Scottish Natural Heritage/SNH *Accept: NatureScot* *Do not accept: Scottish National Heritage*	**1**	Example: The candidate has given both SNH and Scottish National Heritage, and the second part is incorrect. **0 marks** awarded. Where two responses are given, both must be correct.
6.	(a)		Movement/kinetic energy is converted into electrical energy *Do not accept: electricity*	**1**	Example: The response describes the generation process rather than describing the energy change. **0 marks** awarded.
	(b)		No greenhouse gases / other valid response *Response must relate to an environmental benefit.*	**1**	Example 1: The response is insufficient for a mark to be awarded. **0 marks** awarded. Example 2: The response is insufficient for a mark to be awarded: what is meant by a 'clean' fuel source? **0 marks** awarded.
	(c)	(i)	40%	**1**	Candidates had no difficulties with this question in the evidence sampled.
		(ii)	Less visible / more wind offshore / less noise pollution / other valid response *Any two.*	**2**	Example: Wind farms are generally located on unproductive land, but where they are placed on land with agricultural value the land can be put back into crop once construction is complete. **0 marks** awarded. **1 mark** awarded for reduced visible/noise impact. Total marks awarded: **1**

	(d)		Fisherman: fishing may be disrupted; unable to use nets; fish habitats destroyed Coastal hotel owners: views interrupted; noise from turbines Sailing clubs: spoil sailing routes; difficult to navigate around Other valid response. *Any one reason.*	**1**	Example: (Sailing clubs) In UK waters, a 500 m exclusion zone around a wind farm is only in operation during construction. Once completed, boats are free to sail through the farm, but not to tie up to turbines. However, National 5 candidates would not be expected to know this. **1 mark** awarded for exclusion zone.
	(e)		Coal / oil / gas / nuclear / peat	**1**	Example: There is debate over whether waste is a renewable or non-renewable source of energy, revolving around the definition of renewable: capable of being replenished (as per trees) vs not derived from fossil fuels. At best, waste can be classed as a partial renewable source of energy, since it includes waste that originates from both renewable and non-renewable sources. **1 mark** awarded for waste.
7.	(a)		Narrow channel / large water volume / large tidal stream / population density / proximity to National Grid / current water use/ other valid response. *Any three for 1 mark each.*	**3**	Example 1: **1 mark** awarded for 'sufficient water supply', equating to large water volume. **0 marks** awarded for wave movement, since the question is about tidal power, not wave power. **1 mark** awarded for non-disturbance of habitats. Total marks awarded: **2** Example 2: **1 mark** awarded for decent current. **1 mark** for deep water. **0 mark** for the seabed, since the candidates answer is illegible. Total marks awarded: **2**

	(b)		Environmental: disrupts species migration/seabird feeding/seabird populations/ sound disruption of whales/ dolphins/other valid response (**1 mark**) Economic: fishing vessels can't access so lose income / creates jobs which put money into local economy / financial cost of maintenance is high / expensive to connect to National Grid / other valid response (**1 mark**) *Do not accept: greenhouse gases*	**2**	Example 1: **1 mark** awarded for a valid environmental impact. Expensive to construct, maintain, and connect to National Grid, with a very long payback period, so (currently) unlikely to be more cost effective than fossil fuel extraction. **0 marks** awarded. Total marks awarded: **1** Example 2: Powering homes is a social impact, not environmental. **0 marks** awarded. **1 mark** for a valid economic impact. Total marks awarded: **1**
8.	(a)	(i)	A: igneous B: sedimentary C: igneous D: metamorphic E: sedimentary F: metamorphic *6 correct = 3 marks* *4/5 correct = 2 marks* *2/3 correct = 1 mark* *0/1 correct = 0 marks*	**3**	
		(ii)	It contains pore spaces capable of storing water. (**1 mark**) It is formed under the sea so plenty of water is available. (**1 mark**) *Do not accept: because they are porous.*	**2**	Example 1: **1 mark** awarded for large (pore) spaces. **1 mark** awarded for formed in water/able to absorb water. Total marks awarded: **2** Example 2: **1 mark** awarded for location under sea. **0 marks** awarded for comment about water easily passing through loose mud and sand, without mention of pore spaces. Total marks awarded: **1**

	(b)	(i)	Physical weathering (freeze thaw/ frost shattering) (**1 mark**) Chemical/solution weathering (**1 mark**) Biological weathering (**1 mark**) *Any two.*	**2**	Example 1: Weathering occurs due to interaction between the rock and the atmosphere, whereas erosion occurs due to collision between rock fragments. **0 marks** awarded. Rock can decompose as a result of chemical weathering. **1 mark** awarded. Total marks awarded: **1** Example 2: Rain and snow are agents of weathering, not processes. **0 marks** awarded Total marks awarded: **0** Example 3: Thermal weathering and freeze-thaw are both examples of physical weathering. **1 mark** awarded. Total marks awarded: **1**

		(ii)	This rock face will not get much sun as it faces north. It will be very vulnerable to frost shattering in the wet climate. (**1 mark**) Rock/boulders will fall off the cliff onto the road and lead to road closure. (**1 mark**) The faults (weaknesses) will allow water to penetrate, which will speed up the process of frost shattering rock, which will fall onto the road. (**1 mark**) The faults (weaknesses) slope down at an angle towards the road. Frost shattering may prise off very large sections of the cliff face. (**1 mark**) Or other valid response. *Any two.*	**2**	Example 1: **1 mark** awarded for the potential of rock fall to cause accidents to road users. **0 marks** awarded for limestone extraction, since there is no indication of quarrying in the information provided. Total marks awarded: **1** Example 2: The reasons given are both insufficient to be awarded marks: what are the consequences of loose boulders and cliff weakness that requires geologists to monitor them? **0 marks** awarded. Total marks awarded: **0** Example 3: **1 mark** awarded for loose boulders/weak rock structure and potential to damage cars. Total marks awarded: **1**

Question			Expected Answer(s) *and additional guidance*	Max Mark	Commentaries
Section 2					
1.	(a)		The average yearly temperature has increased from 1884 to 2019. Or other valid response.	**1**	Example: The response is insufficient to be awarded the mark; it should refer to (average) temperature rather than heat, and the average temperature increase extends to 2019. **0 marks** awarded.
	(b)		Storm events could result in seawater contaminating groundwater. Or Increased frequency/intensity of storms could stir up sediments in water. Or Higher water temperature will reduce the oxygen content of the water. Or other valid response. *Any one*.	**1**	Example: The response must relate to an aspect of climate change. Bacterial presence reducing the (dissolved) oxygen content of water is a consequence of eutrophication. **0 marks** awarded.
2.	(a)		Detritivore	**1**	Example: A herbivore consumes only plant material, whereas a detritivore consumes dead organic matter, (ie plants and animals). **0 marks** awarded.
	(b)		Juveniles are parasitic/feed on fish blood and body fluids.	**1**	Example 1: Growth and survival is not sufficiently explicit. **0 marks** awarded. Example 2: The response given is incomplete, mentioning only blood and not body fluids. **0 marks** awarded.

	(c)		Temperature change (**1 mark**) could interfere with stages of the lamprey's life cycle. (**1 mark**) Or Warmer waters will hold less dissolved oxygen, (**1 mark**) and affect the lamprey's ability to breathe. (**1 mark**) Or Lower dissolved oxygen (**1 mark**) could affect host fish species' survival so impact lamprey's food source. (**1 mark**) Or other valid response.	**2**	Example 1: The response is insufficient to be awarded a mark: what aspect of water quality, and how would climate change affect this quality? **0 marks** awarded. Total marks awarded: **0** Example 2: **1 mark** awarded for loss of host fish and potential impact on lamprey. Total marks awarded: **1** Example 3: **1 mark** awarded for increasing water temperature affecting lamprey breeding/survival. Total marks awarded: **1**
3.	(a)	(i)	106 (ha) *Do not award mark if value not rounded to 106.*	**1**	Example: Addition of coverage (hectares) is correct but subtraction from 818 is incorrect. **0 marks** awarded.
		(ii)	Adding x-axis labels and y-axis scale (**1 mark**) Accurate plotting (**1 mark**) *x-axis labels should include 'tree species' plus individual bar labels.*	**2**	Example: Candidates were required to plot the percentage of land covered; this candidate has plotted the hectare coverage. **0 marks** awarded for the *y*-axis scale, as it does not match the *y*-axis label. **0 marks** awarded for plotting as the scale used does not allow for accurate plotting. Total marks awarded: **0**
		(iii)	Scottish Natural Heritage/SNH *Accept: NatureScot (new name for SNH)*	**1**	Candidates had no difficulties with this question in the evidence sampled.

		(iv)	The shingle complex must be protected under the SSSI management requirements. Or To maintain the extent of open shingle. Or To slow the rate of gorse spreading onto the shingle. Or other valid response. *Gorse removal aims to maintain the character of the shingle complex.*	**1**	Example 1: Gorse could out-compete other species but would not kill them. **0 marks** awarded. Example 2: Gorse removal is labour intensive, but that is not a reason for having to remove it from this SSSI. **0 marks** awarded.
	(b)	(i)	(Angular) pieces of rock break off *in situ* rock through <u>weathering</u>. (**1 mark**) Collision with other rocks (during transportation) breaks off (angular) pieces through <u>erosion</u>. (**1 mark**) *Response must refer to weathering and erosion processes.*	**2**	Example 1: Rounding of rocks requires erosive processes, not just sitting in water. **0 marks** awarded. Total marks awarded: **0** Example 2: Rocks are rounded during transportation, so a lack of currents would leave a rock angular. **0 marks** awarded. Total marks awarded: **0**
		(ii)	The large (pore) spaces between the stones means that (most water will pass through but) there will be a large surface area on the stones for water to attach to.	**1**	Example: Water draining through rocks is related to permeability rather than porosity. **0 marks** awarded.
4.			£6.57 million *Dearest option = rock armour* *£1 in 1996 = £1.96 in 2020* *£6.84 million × 1.96 = £13.41 million (rounded)* ***(1 mark)*** *£13.41 million – £6.84 million = £6.57 million* ***(1 mark)***	**2**	Candidates had no difficulties with this question in the evidence sampled.

5.			*1 mark for each valid <u>expanded</u> point that relates to the selected option.* *Candidates may cite statements from the evidence provided, but these must then be discussed further. No marks for stating information provided.* *Discussion may offer counter-arguments for the other option but should conclude with why the nominated option should be adopted.* **Yes** The aim of the engineering is to strengthen shingle defences, which would provide added protection to Settlement X. (**1 mark**) People/communities/buildings will be at risk of flooding as a result of sustained breaching of the shingle bank. (**1 mark**) Flooding/loss of Settlement X would **named** social/economic impact on the area eg loss of accommodation/food outlets/toilets/wildlife enthusiasts, (**1 mark**) and reduce tourism revenue to the area. (**1 mark**) Strengthening the shingle complex will ensure continued habitat provision for species living on it. (**1 mark**) The shingle complex supports specialised species, which may be at risk if the shingle banks continue to be eroded by storm events. (**1 mark**) Marine species will be at risk of habitat loss due to construction of a breakwater. (**1 mark**)	**4**	Example 1: (No) **1 mark** awarded for cost over time. **0 marks** awarded for lengthy planning and construction processes (for breakwater), as this information is drawn from Source G and not expanded further. **1 mark** awarded for visual impact/nature disturbance/habitat destruction. Total marks awarded: **2** Example 2: (Yes) **1 mark** awarded for potential cost if not implemented. Total marks awarded: **1** Example 3: (Yes) **1 mark** awarded for rock armour having a natural look (if local stone is used). The other points made in the response are copied from information provided in Source G. The candidate makes a case for shingle extraction, but the aim of the engineering is to strengthen shingle defences. Total marks awarded: **1**

			Revenue from tourism may decrease if the shingle complex degrades further/species are lost/the SSSI status is removed. (**1 mark**) Or other valid response. **No** The shingle complex is constantly shaped by river/coastal processes, so engineering might interfere with these/prove ineffective. (**1 mark**) The shingle complex has formed through natural processes and is designated a SSSI because of these, so should be allowed to continue without intervention. (**1 mark)** Engineering is expensive and intensity/frequency of storm events/precipitation is uncertain (in the longer term), so better/ cheaper to deal with impacts as they arise. (**1 mark**) Breakwater/groyne construction requires below-ground engineering, so will disturb seabed/species and threaten SSSI status. (**1 mark**) Breakwater may obstruct sea lamprey/salmon migration, reducing their spawning potential/ survival. (**1 mark**) Rock armour/groyne has a visual impact that could deter visiting wildlife enthusiasts/tourists, which brings in revenue to the local area. (**1 mark**) Rock groynes may reduce the problem locally but enhance it further along the coast. (**1 mark**) Transportation of construction materials to the site will cause noise/dust/disturbance to locals. (**1 mark**)		

			Transportation of construction materials will emit greenhouse gases, which will enhance global warming/climate change. (**1 mark**) Or other valid response.		

Question			Expected Answer(s) *and additional guidance*	Max Mark	Commentaries
Section 3					
10.	A		*Maximum of 4 marks for either descriptions of damage or discussion of solutions.* **Activities** Chosen activity – fertiliser application/pesticide application/cattle farming **(1)** **Fertiliser application** - fertiliser runoff into waterway **(1)** - causes algal bloom **(1)** - decomposition of algae reduces oxygen **(1)** - death of other organisms **(1)** **Pesticide application** - pesticide may runoff into waterway **(1)** - may kill organisms directly **(1)** - absorbed by aquatic organisms **(1)** - poison water supplies **(1)** **Cattle farming** - slurry runoff into waterway **(1)** - causes algal bloom **(1)** - decomposition of algae reduces oxygen **(1)** - death of other organisms **(1)** - methane emissions contribute to climate change **(1)** - cattle may damage riverbank **(1)** Or other valid response. **Solutions** **Fertiliser application** - organic farming **(1)** - restrict amount of fertiliser spread **(1)** - restrict where/when it can be spread **(1)** - use farmyard manure **(1)** - use nitrogen fixing crops **(1)**	**7**	Example 1: Problems **1 mark** awarded for cattle waste entering the river. **1 mark** awarded for fertiliser (runoff) causing eutrophication. **1 mark** awarded for impact of cattle waste on aquatic life. Solutions **1 mark** awarded for fencing off the field. **1 mark** awarded for fertiliser-free border along river. Total marks awarded: **5** Example 2: Problems **1 mark** awarded for spraying close to the river. **1 mark** awarded for pollution potential from fertiliser/pesticides /herbicides/cattle waste. **1 mark** awarded for issue with cattle drinking polluted water. Solutions **1 mark** awarded for ban on spraying within 5 m of the river, (ie a buffer zone). Total marks awarded: **4**

			Pesticide application - organic farming (**1**) - restrict amount of pesticide spread (**1**) - use biological control (**1**) - crop rotation (**1**) - hand weeding (**1**) **Cattle farming** - have fewer cattle (**1**) - don't have them in fields next to waterways (**1**) - fence off waterways (**1**) - collect slurry and spread in a controlled way (**1**) Or other valid response.		
	B		*Maximum of 4 marks for one method.* *Maximum of 3 marks for a simple list of named methods.* Possible areas of discussion include: - marine conservation zone - sustainable fishing methods - quotas - legislation - net size - consuming alternative species Example of expected response: Net size is a method of conserving fish stocks. (**1**) Smaller nets ensure smaller numbers of fish are caught. (**1**) Larger holes in the net allow small fish to escape, (**1**) and leave behind breeding stock (**1**)	**7**	Example: **1 mark** awarded for nets/cages with larger holes. **1 mark** awarded for larger holes allowing small fish to escape. **1 mark** awarded for setting fishing periods. **1 mark** awarded for limiting catch size. Total marks awarded: **4**

11.	A		*A diagram may be included as part of the response, but the response must also include explanation of the various stages of the cycle.* *Maximum of 3 marks for a correct, labelled diagram of the nitrogen cycle without further discussion.* Processes: Fixation by soil bacteria/lightning (**1**) + leguminous plants/bacteria fix atmospheric N eg clover, peas. (**1**) Nitrate absorption by plants. (**1**) Consumption/feeding by animals. (**1**) Nitrogen for protein synthesis or amino acids. Component of proteins. (**1**) Death and organic waste production (urine/manure). (**1**) Decay/decomposition by fungi and bacteria. (**1**) Nitrification by bacteria (**1**) + ammonia to nitrite then nitrite to nitrate. (**1**) Denitrification by bacteria (**1**) - nitrates to nitrogen. (**1**) The nitrogen cycle results in the recycling of nutrients. (**1**)	**7**	Example 1: The candidate shows they know lightning is involved in the nitrogen cycle, but the description of fixation is confused and insufficient. **0 marks** awarded. Total marks awarded: **0** Example 2: The statement about nitrates entering soil through precipitation is insufficient without reference to the role of lightning/fixation. **1 mark** awarded for nitrate uptake by plant roots. **1 mark** awarded for the link between nitrates and chlorophyll production. **1 mark** awarded for plant consumption by animals. **1 mark** awarded for expelling of urine and faeces. The diagram reflects points made in the discussion and is not awarded any marks. Total marks awarded: **4**

	B		*A diagram may be included as part of the response, but the response must also include explanation of the various stages of the cycle.* *Maximum of 3 marks for a correct, labelled diagram of the carbon cycle without further discussion.* Processes: Photosynthesis (**1**) + photosynthesis word/chemical equation or description. (**1**) Respiration (**1**) + respiration word/chemical equation or description. (**1**) Consumption/feeding by animals. (**1**) Death and organic waste production (urine/manure). (**1**) Decay/decomposition by fungi and bacteria/detritivores and decomposers. (**1**) Formation of fossil fuels. (**1**) Formation of limestone. (**1**) Combustion of fossil fuels (**1**) releases carbon dioxide. (**1**) The carbon cycle results in the recycling of nutrients. (**1**)	**7**	Example: **1 mark** awarded for consumption of grass by animals. **1 mark** for expelling of waste. Total marks awarded: **2**

Skills tagging of questions

The following table provides information on each question in the paper, including: course content being assessed; skills assessed (see below for code explanations); maximum mark; and A-type marks.

The paper has not been used as a live examination and the questions are therefore untested.
Questions labelled with A-type marks are those predicted to perform as A-type.
The marking instructions have not been standardised based on candidate responses.

Skills codes

K1 Demonstrating knowledge and understanding by making statements
K2 Demonstrating knowledge and understanding by describing information and providing explanations
K3 Applying knowledge to new situations, interpreting information, and solving problems

S1 Planning or designing experiments/fieldwork investigations to test given hypotheses or to illustrate particular effects, applying safety measures
S2 Selecting information from a variety of sources
S3 Presenting information appropriately in a variety of forms
S4 Processing information (using calculations and units, where appropriate)
S5 Making predictions and generalisations based on evidence/information
S6 Drawing valid conclusions and giving explanations supported by evidence/justification
S7 Suggesting improvements to practical experiments/fieldwork investigations

Question		Course content – topic and key area	Skills assessed	Maximum mark	A-type marks
Section 1					
1	(a)(i)	Living Environment - Interdependence	K1	1	
	(a)(ii)	Living Environment - Interdependence	K3	1	
	(a)(iii)	Living Environment - Interdependence	K2	2	1
	(a)(iv)	Living Environment - Interdependence	S2	1	
	(b)(i)	Living Environment – Investigating ecosystems and biodiversity	K2	1	
	(b)(ii)	Living Environment – Investigating ecosystems and biodiversity	S4	1	
	(c)(i)	Living Environment - Interdependence	S6	1	
	(c)(ii)	Living Environment - Interdependence	K1	1	
	(c)(iii)	Living Environment - Interdependence	S5	2	1
2	(a)	Sustainability – Water	S2	1	
	(b)	Sustainability – Water	K3	2	1
	(c)(i)	Sustainability – Water	S4	2	
	(c)(ii)	Sustainability – Introduction	K3	1	1
	(d)	Sustainability – Water	K1	1	
	(e)	Sustainability – Water	K1	1	
3	(a)	Sustainability – Food	K1	1	
	(b)(i)	Sustainability – skill	S3	3	
	(b)(ii)	Sustainability – skill	S4	1	
4	(a)	Earth's Resources - Geosphere	K1	1	
	(b)(i)	Earth's Resources – Geosphere	K2	2	2
	(b)(ii)	Earth's Resources – Geosphere	K1	1	
	(c)	Earth's Resources – skill	S4	1	1
	(d)(i)	Earth's Resources – skill	S4	1	
	(d)(ii)	Sustainability – Energy	S5	1	
5	(a)	Living Environment – Human influences on biodiversity	K1	1	
	(b)(i)	Living Environment – Human influences on biodiversity	K3	2	1
	(b)(ii)	Living Environment – Human influences on biodiversity	K3	2	1
	(c)	Living Environment – skill	S4	2	1
	(d)(i)	Living Environment – Interdependence	K3	1	
	(d)(ii)	Living Environment – Human influences on biodiversity	K2	2	1
	(d)(iii)	Living Environment – Human influences on biodiversity	K3	1	
	(d)(iv)	Earth's Resources – Biosphere	K2	2	2
	(d)(v)	Living Environment – Human influences on biodiversity	K1	1	
6	(a)	Earth's Resources – Atmosphere	K1	1	
	(b)	Earth's Resources – Atmosphere	K1	1	
	(c)(i)	Earth's Resources – skill	S4	1	
	(c)(ii)	Earth's Resources – Atmosphere	K2	2	1

Question		Course content – topic and key area	Skills assessed	Maximum mark	A-type marks
	(d)	Earth's Resources – Atmosphere	S6	1	
	(e)	Sustainability – Energy	K1	1	
7	(a)	Earth's Resources - Hydrosphere	K1	3	1
	(b)	Earth's Resources - Hydrosphere	K3	2	1
8	(a)(i)	Earth's Resources – Geosphere	K1	3	
	(a)(ii)	Earth's Resources – Geosphere	K2	2	1
	(b)(i)	Earth's Resources – Geosphere	K1	2	1
	(b)(ii)	Earth's Resources – Geosphere	K2	2	1
Section 2					
1	(a)	Sustainability – skill	S6	1	1
2	(b)	Sustainability – Water	K3	1	
	(a)	Living Environment – Interdependence	K1	1	
	(b)	Living Environment – Interdependence	K2	1	
	(c)	Sustainability – Energy	S5	2	1
3	(a)(i)	Earth's Resources – skill	S4	1	
	(a)(ii)	Earth's Resources – skill	S3	2	
	(a)(iii)	Living Environment – Human influences on biodiversity	K1	1	
	(a)(iv)	Living Environment – Human influences on biodiversity	K3	1	1
	(b)(i)	Earth's Resources – Geosphere	K2	2	1
	(b)(ii)	Earth's Resources – Geosphere	K1	1	
4		Sustainability – skill	S4	2	
5		Living Environment, Earth's Resources, Sustainability	S6	4	2
Section 3					
10	A	Sustainability – Food	K2	7	3
	B	Sustainability – Food	K2	7	3
11	A	Living Environment – Interdependence	K2	7	3
	B	Living Environment – Interdependence	K2	7	3