



National
Qualifications
2023

2023 Environmental Science
Higher - Paper 2
Finalised Marking Instructions

© Scottish Qualifications Authority 2023

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

The information in this document may be reproduced in support of SQA qualifications only on a non-commercial basis. If it is reproduced, SQA must be clearly acknowledged as the source. If it is to be reproduced for any other purpose, written permission must be obtained from permissions@sqa.org.uk.



General Marking Principles for Environmental Science Higher

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, BOD or GPP) 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 Higher.
- 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 bioaccumulation and biomagnification, or qualitative and quantitative;
 - 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 is 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

Question		Expected response	Max mark	Additional guidance
1.	(a)	Increasing population/changes in consumer demand/changes brought about by development/other valid response.	1	Any one
	(b)	(i) Waste decomposing in landfill/ melting permafrost/ <u>rice</u> farming/ other valid response.	1	Any one
		(ii) Reducing the volume of methane emitted by agriculture would help to slow climate change, (1 mark) which would reduce financial impact of crop failure/flooding/damage to property associated with extreme weather events. (1 mark) Or other valid response.	2	
	(c)	(i) Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.	1	Response should refer to access to food of sufficient quality and quantity.
		(ii) Less (productive) land is taken up growing pastures/feed for sheep, (1 mark) therefore the land becomes available to grow crops/rear animals for food for people. (1 mark)	2	1 mark for reduction of land used for production of animal feed. 1 mark for increased land available to produce food for people.
		(iii) The coastline of mainland Scotland is vast, and a wall would be very difficult/expensive to maintain. OR Inland areas will not be able to practice this farming technique. OR Much of Scotland's coastline is very remote and access for maintenance would be challenging. Or other valid response.	1	Any one

Question			Expected response	Max mark	Additional guidance
1.	(d)	(i)	<p>Reduced use of pesticides (used to treat sea lice in high density cages) entering the environment.</p> <p>OR</p> <p>Wild salmon are less likely to suffer from sea lice infestations.</p> <p>Or other valid response.</p>	1	Any one
		(ii)	72 000 (kg)	3	$\pi \times 13.0^2 \times 8.0 = 4247 \text{ m}^3$ (if 3.14 used 4245)
		(iii)	<p>Increased job opportunities in a rural area.</p> <p>OR</p> <p>More money generated in the local economy.</p> <p>Or other valid response.</p>	1	Any one

Question		Expected response	Max mark	Additional guidance
2.	(a)	The relationship or balance between social, economic, or environmental issues.	1	Do not accept definition of sustainable development ie meeting the needs of the present without compromising the ability of future generations to meet their own needs (or similar).
	(b)	(i) Company can evaluate the results and choose a straw material that has the lowest environmental impact(s).	1	
		(ii) Bamboo Lower energy use in manufacture than other materials. (1 mark) Multiple use so longer lasting than harvested stalk or plastic. (1 mark) Is compostable so stored energy or nutrients could be used for growing more bamboo. (1 mark) Or other valid response.	3	1 mark for each valid response based on information provided in the table. Accept valid arguments for glass/steel or harvested stalk but must name which type of straw best fits the circular economy model.
		(iii) Harvesting method/transportation/packaging/expected level of multiple use/availability of recycling facilities/other valid response.	2	Any two
		(iv) More efficient methods of manufacturing/reduce transport/production from recycled materials/other valid response.	1	Any one
		(v) Crop production is energy intensive (tractor fuel, fertiliser production, pesticide production, harvesting etc).	1	

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	Birch	1	
		(ii)	Ash	1	
	(b)	(i)	0.051 cm yr ⁻¹ (or cm per year).	2	1 mark for identifying depth of peat from the pollen profile. 1 mark for correct calculated value, including units. Peat = 450 cm depth Organic artefact at bottom of peat horizon = 8770 years 450 ÷ 8770 = 0.051 Accept 0.05.
		(ii)	The rate of peat formation will vary over time (depending on local climate). OR Relies on accurate ¹⁴ C dating of organic materials. OR The oldest organic material might have been transported and deposited from outside the area (by wind or water). Or other valid response.	1	
	(c)	(i)	Ash does not grow on acidic soils, (1 mark) which suggests that the soil was not very acidic during the time when the soil (now found at 280-390 cm) was the surface deposit. (1 mark)	2	1 mark for edaphic factor named in table. 1 mark for correct explanation.
		(ii)	Downy birch Grows mostly in the west, and Barra lies off the northwest coast. OR Prefers wetter conditions, along with most of the other species present in the pollen profile.	1	1 mark for appropriate justification.

Question			Expected response	Max mark	Additional guidance
3.	(c)	(iii)	Paired statement keys are based on identifying specific visual physical characteristics of a species, (1 mark) and hybrids may share a mix of physical characteristics from each parent. (1 mark)	2	
		(iv)	(Loss of the keystone species) could drastically change the ecosystem as other species depend on its presence.	1	Response must convey the scale of change and interdependence.
		(v)	Primary succession occurs on bare ground/where no soil is present (1 mark) and trees require soil to be present for seeds to germinate. (1 mark)	2	1 mark for valid reference to primary succession eg no soil. 1 mark for valid reference to secondary succession eg soil is required for germination, nutrients etc.

Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	Temperate deciduous forest.	1	
		(ii)	9 - 16 °C	1	Accept +1 for either value.
	(b)	(i)	The rate at which an ecosystem accumulates energy/biomass, excluding the energy used for respiration.	1	Accept NPP = GPP - respiration.
		(ii)	Rain gauge. (1 mark) Measure of height of precipitation collected over a set period of time. (1 mark)	2	1 mark for appropriate equipment. 1 mark for description of use.
		(iii)	As the precipitation increases from 0 - 2200 (mm year ⁻¹), the NPP increases to 2150 (g m ⁻² year ⁻¹). (1 mark) After this, the NPP decreases as precipitation increases. (1 mark)	2	An approximate turning point must be identified. Max of 1 mark if values are not included. Units not required but if included must be correct. No marks awarded for overall trend (eg as precipitation increases, NPP increases).
		(iv)	Tropical forest. (1 mark) Because it lies/falls within the optimum temperature AND optimum precipitation level. (1 mark)	2	Give credit for the inclusion of appropriate values from graphs in place of 'optimum temperature and precipitation level'.

Question		Expected response	Max mark	Additional guidance
5.	(a)	<p>Shape Varies from elliptical to nearly circular. (1 mark) When the orbit is circular, the amount of insolation received on an annual basis is greater, (1 mark) and the Earth's temperature increases. (1 mark)</p> <p>Tilt The angle of tilt varies over time. (1 mark) Greater tilt means more severe seasonal variation. (1 mark) Cool summers allow snow and ice to persist at high latitudes/build up into ice sheets. The high albedo of snow and ice causes additional cooling. (1 mark)</p> <p>Orientation Changes over a period of time, and is driven by tidal changes influenced by the Sun and the Moon. (1 mark)</p> <p>This results in one polar hemisphere being closer to the Sun than the other, (1 mark) changing the amount of insolation reaching each. (1 mark)</p>	3	Any diagrams must be annotated.
	(b)	<p>Volcanic activity (1 mark) reduces the Earth's temperature due to the introduction of ash and other particulates into the upper atmosphere. (1 mark)</p> <p>OR</p> <p>Sunspot activity (1 mark) During periods of maximum sunspot activity, the Sun emits more energy increasing Earth's temperature. (1 mark)</p>	2	

Question		Expected response	Max mark	Additional guidance
6.	(a)	The Sun	1	
	(b)	27 335 (litres)	1	$\frac{1\,000\,000}{439} \times 12 = 27\,335$ <p>Must be rounded to the nearest litre.</p>
	(c)	<p>Positive + people Creation of jobs</p> <p>OR</p> <p>Export of lithium brings money to local economy and can be spent on amenities.</p> <p>Positive + environment: Using rechargeable batteries reduces the amount sent to landfill.</p> <p>OR</p> <p>Electric cars can be made, which reduces dependency on fossil fuels.</p> <p>Negative + environment: Water shortages will cause populations of wild animals to decrease.</p> <p>OR</p> <p>Mine development will cause habitat destruction.</p> <p>Or other valid response.</p>	3	<p>1 mark for each category.</p> <p>Accept direct and indirect impacts.</p>
	(d)	<p>Country can control the price.</p> <p>OR</p> <p>Political instability may lead to resource insecurity.</p> <p>OR</p> <p>Environmental degradation is concentrated in one country.</p> <p>Or other valid response.</p>	1	Any one

Question			Expected response	Max mark	Additional guidance
6.	(e)	(i)	<p>Raw materials will have to be transported from the Democratic Republic of Congo and Chile for battery assembly, (1 mark)</p> <p>and the transportation will most likely be fuelled by fossil fuels, (1 mark)</p> <p>which will release CO₂. (1 mark)</p> <p>OR</p> <p>A sharp increase in electric car sales in the UK will require more mining of cobalt/lithium, (1 mark)</p> <p>which will destroy habitats/decrease water security. (1 mark)</p> <p>Or other valid response.</p>	2	
		(ii)	<p>Lack of charging points/facilities.</p> <p>OR</p> <p>Higher cost of electric vehicles compared to petrol and diesel.</p> <p>OR</p> <p>Limited range of electric vehicles.</p> <p>OR</p> <p>High cost of charging vehicles.</p> <p>Or other valid response.</p>	1	

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	More jobs/good transport links/ niche jobs/more opportunities for education/more entertainment/ other valid response.	1	Any one
		(ii)	Soil erosion (1 mark) occurs as there is no root system to bind soil. (1 mark) OR Increased rates of flooding (1 mark) as no vegetation/soil to absorb/ intercept/store water. (1 mark) Or other valid response.	2	1 mark for impact. 1 mark for explanation.
	(b)	(i)	Carbon dioxide (1 mark) from burning fossil fuels/cement production/vehicle emissions/ electrical generation. (1 mark) OR Water vapour (1 mark) from burning fossil fuels/vehicle emissions/electrical generation. (1 mark) OR Methane (1 mark) from sewage treatment/landfill. (1 mark) OR Nitrous oxides (1 mark) from vehicle emissions/solvent use/industrial processes/train emissions/electricity generation. (1 mark) Or other valid response.	2	1 mark for a greenhouse gas emitted in an urban environment. 1 mark for a valid source of the greenhouse gas. The source must correspond to the named greenhouse gas.
		(ii)	Longer drives to destination/greater need for transport/emissions from agriculture in rural areas/using oil for heating/other valid response.	1	Any one

Question			Expected response	Max mark	Additional guidance
7.	(c)	(i) (A)	33.44 Mt CO ₂ equivalent.	2	Must include unit. Accept: e for equivalent $76 \times \frac{56}{100} = 42.56$ (1 mark) $76 - 42.56 = 33.44$ (1 mark)
		(B)	Graph shows too gradual a decrease. OR The graph shows there has never been such a large decrease in emissions. Or other valid response.	1	
		(ii)	No travelling to school or work/ industries and workplaces closed/ manufacturing stopped/ flights banned/ other valid response.	1	
		(iii)	Ban cars in city/introduce low emission zones/encourage walking, cycling or carpooling/install charging points for electric vehicles/build cycle or walking paths/use electric trams powered by renewables/install or use energy generated by carbon-free energy systems (eg solar panels/wind turbines/biofuel)/other valid response.	2	Any two
	(d)		Greenhouse gases in the atmosphere prevent radiation from being reflected/reradiated back into space. (1 mark) OR Greenhouse gases absorb radiation and retain heat in the atmosphere. (1 mark) Thereby increasing global temperatures higher than they should be. (1 mark)	2	1 mark for the impact of greenhouse gases. 1 mark for linking impact to rising global temperatures.

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	Thermohaline circulation. Surface wind currents.	2	Accept: Salinity/salt concentration. OR Temperature gradient/differences. OR Formation of sea ice. 1 mark for each. If thermohaline + salinity or temperature differences. (1 mark) If thermohaline + salinity and temperature differences. (2 marks) Do not accept: salt, temperature.
		(ii)	Ocean water in polar regions cools and forms sea ice. (1 mark) This draws out the freshwater causing the surrounding water to get saltier. (1 mark) This increases the density and the cold water starts to sink. (1 mark) Surface water is pulled in to replace the sinking water. (1 mark)	3	
	(b)	(i)	The rising up of deep/cold/nutrient-rich water in the open ocean along coastlines.	1	Response should refer to upward movement, an appropriate characteristic of the water, and location.
		(ii)	The rising water (is nutrient rich, which) supports a (sustained) increase in the population of autotrophs/primary producers. (1 mark) This increases the number of available niches/provides an energy source for other organisms/consumers. (1 mark)	2	

Question		Expected response	Max mark	Additional guidance
9 A	(a)	<p>Constructive process.</p> <p>Constructive plate boundaries are mostly found in oceans, (1 mark) where the plate type is oceanic crust on both sides. (1 mark)</p> <p>Convection currents in the upper mantle (1 mark) diverge/spread, forcing the plates above apart. (1 mark) (As the plates move apart) the underlying mantle melts and becomes less dense and rises towards the (seabed) surface. (1 mark)</p> <p>The molten magma erupts through the thinning crust and fills the gap between the plates (1 mark) as lava, (1 mark) creating new oceanic crust (1 mark) in a process known as seafloor spreading. (1 mark)</p> <p>Or other valid response.</p>	10	<p>Maximum of 7 marks for constructive process (convection).</p> <p>Maximum of 7 marks for seabed landforms and deposits.</p> <p>Accept use of divergent plate boundary as an alternative name.</p> <p>Give credit for candidate responses relating to emerging theories relating to plate movement and convection.</p> <p>Give credit for appropriate annotated diagram(s), which must be supported with descriptive statements. Max of 5 marks if no supporting statements are provided.</p> <p>Give credit for use of examples with appropriate supporting discussion eg mid-Atlantic Ridge or formation of volcanic islands such as Iceland (not Hawaiian islands as these formed over a hotspot/pluton a long distance from constructive plate boundary).</p> <p>Give credit for use of more complex terms such as ridge-push (but not slab-pull as it relates to destructive process, not constructive), pillow lava, rift valleys, fracture zones/transform faults.</p> <p>Do not double credit for similar information in response to each part of the question eg eruption of molten magma.</p> <p>Do not credit discussion of continental landforms.</p>

Question		Expected response	Max mark	Additional guidance
9 A	(b)	<p>Resulting seabed features and deposits</p> <p>As the plates diverge, magma rises and erupts through weak points in the stretched crust. (1 mark)</p> <p>Volcanoes When the magma reaches the surface, it cools as it meets cold seawater, (1 mark) and solidifies to form ridges of new igneous rock. (1 mark) The ridges are often unstable and chains of underwater volcanoes form along the spreading plate margins. (1 mark)</p> <p>Hydrothermal vents Deep faults form in the (oceanic) crust when the plates diverge. (1 mark) Cold seawater percolates downwards through these, and is superheated through contact with the magma. (1 mark) The seawater returns to the seafloor via hydrothermal vents (1 mark) often known as smokers. (1 mark)</p> <p>Metallic minerals The superheated fluids released from hydrothermal vents often contain dissolved metallic minerals. (1 mark) As the heated fluids make contact with cold seawater, the minerals precipitate out and are deposited on the seafloor. (1 mark) Examples of metallic minerals include sulfur, copper, gold, zinc, iron. (1 mark)</p> <p>Or other valid response.</p>		<p>Maximum of 7 marks for constructive process (convection).</p> <p>Maximum of 7 marks for seabed features and deposits.</p> <p>Accept use of divergent plate boundary as an alternative name.</p> <p>Give credit for appropriate annotated diagram(s), which must be supported with descriptive statements. Max of 5 marks if no supporting statements are provided.</p> <p>Give credit for use of examples with appropriate supporting discussion eg mid-Atlantic Ridge or formation of volcanic islands such as Iceland (not Hawaiian islands as these formed over a hotspot/pluton a long distance from constructive plate boundary).</p> <p>Give credit for use of more complex terms such as ridge-push (but not slab-pull as it relates to destructive process, not constructive), pillow lava, rift valleys, fracture zones/transform faults.</p> <p>Do not double credit for similar information in response to each part of the question eg eruption of molten magma.</p> <p>Do not credit discussion of continental landforms.</p>

Question		Expected response	Max mark	Additional guidance
9. B	(a)	<p>Water movement processes:</p> <ul style="list-style-type: none"> • evaporation • condensation • precipitation • infiltration • percolation • transpiration • evapotranspiration • sublimation • runoff <p>Evaporation As solar energy/heat from the Sun warms surface water, (1 mark) the physical state of the water changes from liquid to gas/vapour. (1 mark)</p> <p>Condensation As gas/vapour cools, the physical state changes to liquid, (1 mark) which coats particles (eg dust, salt, smoke) in the air, forming droplets that combine into dew/fog/clouds. (1 mark)</p> <p>Precipitation Is the moisture that falls as rain/snow/sleet/hail/drizzle or forms fog/mist. (1 mark) The volume/intensity/form/geographic location (1 mark) of the precipitation will influence whether the water will form a flow/runoff or infiltrate into the ground. (1 mark)</p> <p>Infiltration Is the physical movement of water through soil. (1 mark) It is influenced by ground cover/existing moisture content of the soil/temperature/rainfall intensity. (1 mark)</p> <p>Percolation Is the movement of water through pore spaces in soil/rock by gravity and capillary action. (1 mark)</p>	10	<p>Give credit for appropriate annotated diagram(s), which must be supported with descriptive statements. Max of 5 marks if no supporting statements are provided.</p> <p>Max of 7 marks for water movement processes. Max of 4 marks for water storage.</p> <p>Accept other movement processes eg interception - the capture of precipitation by vegetation or other barriers (natural or man-made), preventing precipitation reaching the ground surface.</p>

Question		Expected response	Max mark	Additional guidance
9 B	(a)	<p>Transpiration Is the evaporation of water from plant leaves/stem/flowers. (1 mark)</p> <p>Evapotranspiration Is the loss of water to the atmosphere from the land surface AND plants. (1 mark)</p> <p>Sublimation Is the process by which ice or snow changes from a solid to a gas without becoming a liquid. (1 mark)</p> <p>It occurs when there is low humidity/dry winds/low air pressure/at high altitude. (1 mark)</p> <p>Runoff Is the flow of water over land as surface water. (1 mark) It is influenced by rainfall intensity/duration/ground slope/soil type/ground cover. (1 mark)</p>		

Question		Expected response	Max mark	Additional guidance
9 B	(b)	<p>Storage can be both surface and subterranean. (1 mark)</p> <p>Surface storage includes:</p> <ul style="list-style-type: none"> - atmospheric moisture - soil moisture (in upper horizons) - snow - ice/glaciers/ice caps - watercourses/rivers/streams - lakes - oceans. <p>(max of 3 marks for surface examples)</p> <p>Subterranean storage includes:</p> <ul style="list-style-type: none"> - groundwater/in pore spaces in rock/sediments/soil (lower horizons) - aquifers/underground layer of water-bearing permeable rock. <p>(max of 2 marks for subterranean examples)</p>		

Question	Expected response	Max mark	Additional guidance
10. A	<p>The key environmental agencies in Scotland are:</p> <ul style="list-style-type: none"> - NatureScot/NS - Scottish Environmental Protection Agency/SEPA - Forestry and Land Scotland/FLS - Scottish Forestry/SF - Marine Scotland/MS <p>(Award 1 mark for naming two agencies. Award 2 marks for naming 3 or more agencies)</p> <p>These agencies share common roles, including:</p> <ul style="list-style-type: none"> - Enforcing legislation (1 mark) - Providing advice: to Scottish ministers/local authority planners/landowners/land users/voluntary organisations (1 mark) - Shaping national policies (1 mark) - Educating the public (1 mark) - Research and monitoring (1 mark) <p>Each agency has its own area of responsibility in environmental protection. (1 mark)</p> <p><u>NatureScot/NS</u></p> <ul style="list-style-type: none"> - Protects and promotes Scotland's natural heritage by (1 mark) - designating sites of special scientific interest (SSSIs) on account of their flora/fauna/geology/geomorphology (or named examples) (1 mark) and Marine Protected Areas (MPAs) on account of their flora/fauna/geology/geomorphology (or named examples) (1 mark) 	10	<p>Accept abbreviations of agency names, but these must be correct.</p> <p>Do not award Scottish Natural Heritage/SNH or Forestry Commission Scotland/FCS as these agency names changed in 2019.</p> <p>Max of 4 marks if only one agency discussed.</p> <p>Max of 4 marks for listing roles of at least two agencies, with no discussion.</p> <p>Max of 3 marks for common roles.</p> <p>Give credit for demonstration of additional knowledge. For example: NatureScot - designation of: Special Areas of Conservation (SACs) for conservation of high-quality natural habitats and wild flora and fauna; Special Protection Areas (SPAs) for bird species and habitats of particular importance; National Nature Reserves (NNRs) for nationally or internationally important habitats or species.</p> <p>Do not award marks for the following as these are not key <u>environmental</u> agencies:</p> <ul style="list-style-type: none"> - Scottish Water, provides public drinking water supplies; monitors treatment and disposal of sewage. - Marine Coastguard Agency, has responsibility for pollution from shipping and offshore installations. - Local authorities, which have responsibility for noise control; collection, recycling and disposal of household waste, and management of litter (including beach litter, fly tipping); local nature reserves. - Historic Environment Scotland, which investigates, cares for, and promotes Scotland's historic environment.

Question	Expected response	Max mark	Additional guidance
10. A	<p><u>Scottish Environmental Protection Agency/SEPA</u></p> <ul style="list-style-type: none"> - Protects Scotland’s air, land, and water, specifically discharges of wastes to water/beaches/bathing waters (1 mark) - emissions to air (1 mark) - abstraction of water from surface water and groundwater (1 mark) - waste sites (1 mark) (eg landfill, recycling centres, waste contractors, movement of waste, illegal waste disposal) (1 mark) - diffuse pollution (1 mark) - noise at industrial sites (1 mark) - use/storage/disposal of radioactive material or waste (1 mark) - flood warnings (1 mark) <p><u>Forestry and Land Scotland/FLS</u></p> <ul style="list-style-type: none"> - Manages Scotland’s national forests, to enhance biodiversity/ support tourism/increase access to green spaces/improve physical and mental health and wellbeing. (max of 2 marks for examples) - provides timber supplies. (1 mark) <p><u>Scottish Forestry/SF</u></p> <ul style="list-style-type: none"> - Responsible for forestry policy/ support/legislation to... (1 mark) <p><u>Marine Scotland</u></p> <ul style="list-style-type: none"> - Protects Scotland’s coastal waters and seas through integrated management, - Including issuing licences for marine renewables to increase energy resilience/fishing vessels to conserve fish stocks/ freshwater fisheries/ aquaculture/seal control. (max of 2 marks for examples) 		

Question	Expected response	Max mark	Additional guidance
10. B	<p>Population growth depends on the birth rate exceeding the death rate. (1 mark)</p> <p>If there are sufficient resources available to support individuals, there will be an increase in population over time. (1 mark)</p> <p>The environmental limitation is the carrying capacity (1 mark) which is the maximum population size of a species that the environment can sustain indefinitely. (1 mark)</p> <p>Initially, the species experiences exponential growth (1 mark) which displays as a J-shaped curve. (1 mark)</p> <p>Once the population reaches the carrying capacity of its environment, resources will become scarce and population growth will slow. (1 mark)</p> <p>This is known as logistic growth (1 mark) and displays as an S-shaped curve. (1 mark)</p> <p>A population may temporarily exceed the carrying capacity, known as overshoot (1 mark) before decreasing as the species dies off/crashes due to lack of resources (1 mark) and density-dependent interactions (1 mark) such as competition or disease or predation. (1 mark)</p>	10	The focus must be on population-environment dynamics rather than predator-prey cycles.

Question		Expected response	Max mark	Additional guidance
10. B		<p>If individuals from different species are competing for similar resources, this is inter-specific competition. (1 mark)</p> <p>A weakened population may then be more susceptible to predation, which will further reduce numbers. (1 mark)</p> <p>The reduction in population allows the environment to recover and the species will start to increase in numbers as more resources become available. (1 mark)</p> <p>The series of population overshoots and crashes is known as an oscillation. (1 mark)</p>		

[END OF MARKING INSTRUCTIONS]