

Polar cell	Part of the tri-cellular model, the Polar cell lies from 60°N to the North Pole (replicated in the southern hemisphere). Cold air sinks at the North Pole, creating an area of high pressure, before flowing south at the surface, where it is warmed by contact with land and/or ocean and rises around 60°N, creating an area of low pressure.
Policy	A plan of action that focuses on a specific target.
Pollutant	A substance that contaminates air, water or soil.
Pollution	The presence in the environment of substances in quantities that cause harm to the environmental components.
Population	A group of individuals of the same species living in the same area at the same time.
Population crash	A sudden decline in the numbers of individual members in a population, species or group of organisms, usually in response to scarcity of resources, intra-specific competition and/or other biotic factors.
Population dynamics	The study of the factors and their interactions that influence the number and density of populations in time and space.
Population growth	An increase in the size of a population over a given time period.
Population oscillation	A pattern characterised by a population explosion, resulting in overshoot of the carrying capacity, followed by population crash, then recovery of the environment and resources, which allows the population to recover and then exceed the carrying capacity again.
Population overshoot	A temporary situation that occurs when a population exceeds its carrying capacity, before lack of resources causes a population crash.
Pore space	The volume in soil or rock that can be filled with water or air. The pore space properties determine fluid flow through the soil or rock, known as porosity.
Porosity	A measure of a rock's ability to hold fluid.
Precipitation	Moisture that falls from the air to the ground (rain, snow, sleet, hail, drizzle, fog, mist).
Predator	An animal that lives by killing and consuming other animals.
Predator–prey cycle	As a population of one species increases, its predator populations will increase in response. As the prey numbers fall due to predation, the predator numbers will also fall due to reducing resource availability.
Prey	An animal that is hunted and killed by another for food.
Primary consumer	A herbivore that eats the autotroph/producer in a food chain.
Primary productivity	A measure of the rate at which new organic matter develops through photosynthesis.
Primary succession	The colonisation of a new site by communities of plants and animals after an event has removed all existing soil, for example glaciation or a lava flow. This type of succession must first wait for soil to develop sufficiently to support colonising species.

Processed biofuel	A biofuel that has been subject to an industrial process.
Psychological obsolescence	This is when a consumer is persuaded that they need a new product even when their existing product is working well.
Purification	The removal of undesirable chemicals, biological contaminants, suspended solids, and gases to produce water fit for a specific purpose.
Pyrolysis	The chemical decomposition of organic material through the application of heat in the absence of air and oxygen.
Quadrat	A frame enclosing a known unit area which is used to assess species abundance.
Qualitative data	Descriptive data, can be used to prepare species lists.
Quantitative data	Numerical data gathered through measuring or counted.
Radioactive decay	The process by which an unstable atomic nucleus loses energy by emitting radiation in the form of particles or electromagnetic waves, thereby transitioning towards a more stable state.
Random sampling	Sampling where every individual in a population has an equal and independent chance of being selected, ie sampling without conscious decision.
Reforestation	The process of replanting an area with trees. Differs from afforestation, which is the planting of new areas where there was no previous tree cover.
Relative abundance	How common or rare a species is relative to other species in a defined area or community. Is expressed as a percentage of the total number of organisms in the area.
Reliability	The extent to which an experiment, test, or measuring procedure yields the same results on repeated trials. For the data to be reliable, the variation across the values must be small.
Relief	The highest and lowest elevation points on a land surface. Also known as terrain.
Respiration	A chemical process in which energy is released from stores in the body.
Rewilding	Intentional activities which initiate or accelerate the recovery of a habitat or an ecosystem with respect to its health, integrity and sustainability.
Rift valley	Forms when two continental plates diverge, causing stretching and fracturing of the crust. The land between the faults collapses into a deep, wide valley.
Runoff	The flow of water over land as surface water.
Screening (sewage)	The removal of larger objects such as rags, paper, plastics, and metals at a wastewater treatment plant.
Sea level	Mean sea level is the average height of the ocean's surface between high and low tide. Relative sea level is the position and height of the sea relative to the land.
Secondary consumer	An animal that eats the primary consumer in a food chain.
Secondary productivity	The assimilation of food into new biomass through the transfer of organic material between trophic levels.

Secondary succession	Succession that occurs on a pre-existing soil after primary succession has been disrupted or destroyed and the ecological community has been disturbed.
Sedimentation	The settling out of suspended particles and floc on sewage liquor.
Selective breeding	The breeding of plants and animals for particular characteristics.
Seral stages	The stages of succession in an ecosystem advancing towards its climax community. Examples of seres include xerosere, hydrosere, psammosere.
Sewage liquor	A mixture of raw or settled wastewater and suspended solids.
Sewage sludge	The semi-liquid slurry residue from the wastewater treatment process.
Shale gas	Natural gas (methane) found trapped within impermeable shale deposits.
Simple random sampling	Sampling where every individual in a population has an equal and independent chance of being selected, and the average sample should accurately represent the population.
Simpson's biodiversity index	A measure of diversity which takes into account the number of species present, plus the relative abundance of each species.
Site of special scientific interest (SSSI)	A formal conservation designation for an area which has extremely high conservation value because of its plants, animals, geological, or landscape features.
Smelting	A process by which metal is obtained from its ore by heating it beyond the melting point.
Soil profile	The layering of soil horizons.
Soil stability	The ability of soil to maintain its structure to allow passage of air and water, withstand erosive forces (wind and water), and provide a medium for plant roots.
Soil structure	Describes the physical arrangement of the solid parts of soil and of the pore spaces lying between them. Influences porosity; permeability; movement of water, nutrients and gases; and land use.
Soil texture	Refers to the overall feel of soil, reflecting the proportions of mineral particles (sand, silt, and clay) present. These, and organic matter, influence soil structure, water and nutrient retention, drainage, root penetration, soil stability, and cultivation.
Solar flare	A sudden, rapid, and intense variation in the Sun's brightness. Occurs when magnetic energy that has built up in the solar atmosphere is suddenly released.
Solar radiation	Radiant energy emitted by the Sun.
Species	A group of organisms that can interbreed to produce fertile offspring.
Species diversity	A measure of the number of different species present in a given area, rather than the abundance of each species.
Species richness	The number of species present in a sample or an area.

Standard deviation	<p>A measure used to quantify the amount of variation or spread of a set of data values.</p> <p>Commonly used standard deviation formula include: for a population</p> $s = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$ <p>or, for a sample of a population</p> $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} \quad \text{or} \quad s = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n - 1}}$ <p>where: s is the standard deviation N is the population size n is the sample size \bar{x} is the mean \sum is the 'sum of'</p>
Steam methane reforming	The reaction of natural gas with steam in the presence of a catalyst to produce hydrogen and carbon.
Strategic environmental assessment (SEA)	Aims to provide for a high level of protection of the environment from development. It is mandatory for plans and/or programmes which relate to large-scale changes in land use.
Strategy	The methods and principles needed to achieve a policy are set out in a strategy.
Stratified random sampling	Sampling where the population is divided into categories (strata) then a random sample is selected from each category. The size of each sample should be proportional to the size of each category within the population.
Subduction zone	The point at which an oceanic plate is forced underneath a continental plate at a destructive plate boundary.
Sublimation	The process by which ice or snow goes from a solid to a gas without becoming a liquid.
Succession	The series of changes in an ecosystem when one community is replaced by another community as a result of changes in biotic and abiotic factors.
Sunspot	A sunspot is a region on the surface of the sun that is temporarily cool and dark compared to surrounding regions. Powerful magnetic fields around sunspots produce active regions on the Sun.
Superheating	The heating of a liquid, under pressure, to a temperature higher than its boiling point, without actually boiling.

Sustainability	The relationship or balance between social, economic and environmental issues.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Surface wind patterns	The arrangement, location, velocity of the various dominant wind patterns blowing across the Earth's surface.
Systematic random sampling	Sampling where a starting point is randomly chosen, and then a regular pattern of sampling is used to collect the sample.
Tailings	Waste from the mining industry. May be solid waste material (gangue) or fine waste suspended in water.
Technological obsolescence	This is when a new technology or product supersedes the old, even if the old technology is still functional.
Temperate rainforest	Coniferous or broadleaf/deciduous forests that occur in the temperate zone (average temperature between 0-20 °C, largely influenced by nearby ocean) and receive at least 200 cm of annual rainfall.
Tertiary consumer	An animal that eats the secondary consumer in a food chain.
Thermohaline circulation	Circulation driven by differences in seawater density, caused by temperature and salinity.
Transect	A method which investigates distribution of organisms in relation to a fixed area by recording all the species found at points or in a quadrat placed at certain intervals along a line.
Translocation	The downward movement of water or materials in soil. Includes leaching, eluviation, illuviation, and capillary action.
Transpiration	The evaporation of water from a plant's leaves, stem or flowers.
Transportation	The movement of rock fragments by water, ice, wind or gravity from the place where they were originally weathered.
Trent biotic index	A measure which uses freshwater invertebrates to compare water quality at different points in a stream or river.
Tri-cellular model	A model that explains the redistribution of energy from areas of surplus to areas of deficit via three different air masses — the Hadley, Ferrel, and Polar cells.
Trophic	Relating to feeding and nutrition.
Trophic level	A level or position in a food chain, occupied by a group of organisms that have a similar feeding mode, ie autotrophs and heterotrophs (herbivores, carnivores, omnivores).
Tundra	May be arctic or alpine. Arctic tundra is located in the northern hemisphere encircling the North Pole and is known for its cold, desert-like conditions, and very short growing season of around 60 days. Alpine tundra is located at high altitude where trees cannot grow, temperatures are low, and the growing season is around 180 days.
Upwelling	The rising up of deep, cold, nutrient-rich water in the open ocean or along coastlines.
Validity	Encompasses the entire experiment and establishes whether the data obtained meet all the requirements of the research method.

Waste hierarchy	A ranking of waste management options according to what is best for the environment. Gives top priority to waste prevention. When waste is created, it gives priority to preparing it for reuse, then recycling, then energy recovery, with disposal to landfill as a last resort.
Waste prevention	The process of minimising the quantity (weight and volume) and hazardousness of waste.
Waste recovery	The selective extraction of disposed materials for a specific next use, such as recycling, composting or energy generation.
Waste recycling	Reprocessing materials into new products.
Waste reuse	The process of refilling or finding another use for a product without processing it other than cleaning.
Water security	Exists when all people, at all times, have sustainable access to adequate quantities of water of acceptable quality for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.
Weather	The state of the atmosphere at a particular place and time with respect to variables such as temperature, moisture, wind velocity, and air pressure.
Weathering	The exposure and breaking down of rocks <i>in situ</i> at the Earth's surface over geological time due to interaction with the atmosphere.

Preparing for course assessment

Each course has additional time which may be used at the discretion of teachers and/or lecturers to enable candidates to prepare for course assessment. This time may be used near the start of the course and at various points throughout the course for consolidation and support. It may also be used towards the end of the course, for further integration, revision and preparation and/or gathering evidence for course assessment.

During delivery of the course, opportunities should be found:

- ◆ for identification of particular aspects of work requiring reinforcement and support
- ◆ to develop skills of scientific inquiry and investigation in preparation for the assignment
- ◆ to practise question paper techniques

Developing skills for learning, skills for life and skills for work

Teachers and/or lecturers should identify opportunities throughout the course for candidates to develop skills for learning, skills for life and skills for work.

Candidates should be aware of the skills they are developing and teachers and/or lecturers can provide advice on opportunities to practise and improve them.

SQA does not formally assess skills for learning, skills for life and skills for work.

There may also be opportunities to develop additional skills depending on approaches being used to deliver the course in each centre. This is for individual teachers and lecturers to manage.

Candidates are expected to develop broad generic skills as an integral part of their learning experience.

For this course, it is expected that the following skills for learning, skills for life and skills for work will be significantly developed, with potential opportunities to practise or improve these skills provided in the following tables. These are based on [SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work](#). The level of these skills should be appropriate to the level of the course.

Some examples of potential opportunities to practise or improve these skills are provided, as follows:

Literacy

Writing means the ability to create texts which communicate ideas, opinions and information, to meet a purpose and within a context. In this context, 'texts' are defined as word-based materials (sometimes with supporting images) which are written, printed, Braille or displayed on screen. These will be technically accurate for the purpose, audience and context.

1.2 Writing

Candidates develop the skills to effectively communicate key areas of environmental science, make informed decisions and describe, clearly, environmental science issues in various media forms.

Candidates have the opportunity to communicate applied knowledge and understanding throughout the course, with an emphasis on applications and environmental, economic, social, and ethical impacts.

There will be opportunities to develop the literacy skills of listening and reading, when gathering and processing information in environmental science.

Numeracy

This is the ability to use numbers in order to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results.

Candidates have opportunities to extract, process and interpret information presented in numerous formats including tabular and graphical. Practical work provides opportunities to develop time and measurement skills.

2.1 Number processes

Number processes means solving problems arising in everyday life through carrying out calculations, when dealing with data and results from experiments/investigations and everyday class work, making informed decisions based on the results of these calculations and understanding these results.

2.2 Money, time and measurement

This means using and understanding time and measurement to solve problems and handle data in a variety of environmental science contexts.

2.3 Information handling

Information handling means being able to interpret environmental science data in tables, charts, maps and other graphical displays to draw sensible conclusions throughout the course. It involves interpreting the data and considering its reliability in making reasoned deductions and informed decisions. It also involves an awareness and understanding of the chance of events happening.

Employability, enterprise and citizenship

4.6 Citizenship

Citizenship includes having concern for the environment and for others, being aware of rights and responsibilities, being outward-looking towards society; being able to recognise one's personal role in this context, being aware of global issues, understanding one's responsibilities within these and acting responsibly. Candidates develop citizenship skills, when considering the applications of environmental science on our lives, as well as ethical implications.

Thinking skills

This is the ability to develop the cognitive skills of remembering and identifying, understanding, applying. The course allows candidates to develop skills of applying, analysing and evaluating. Candidates can analyse and evaluate practical work and data by reviewing the process, identifying issues and forming valid conclusions. They can demonstrate understanding and application of the key areas and explain and interpret information and data.

5.3 Applying

Applying is the ability to use existing information to solve environmental science problems in different contexts, and to plan, organise and complete a task, such as an investigation.

5.4 Analysing and evaluating

Analysis is the ability to solve problems in environmental science and make decisions that are based on available information. It may involve the review and evaluation of relevant information and/or prior knowledge to provide an explanation. It may build on selecting and/or processing information, so is a higher skill.

5.5 Creating

This is the ability to design something innovative or to further develop an existing thing by adding new dimensions or approaches. Candidates can demonstrate their creativity, in particular, when planning and designing environmental science experiments or investigations. Candidates have the opportunity to be innovative in their approach. Candidates also have opportunities to make, write, say or do something new.

In addition, candidates will also have opportunities to develop working with others.

Working with others

Learning activities provide many opportunities, in all areas of the course, for candidates to work with others. Experimental and field work activities and investigations, in particular, offer opportunities for group work, which is an important aspect of environmental science and should be encouraged.

Appendix 2: question paper brief

The question paper will sample knowledge, understanding and skills from across the course.

Content

120 marks will be evenly distributed across each of the three content areas:

- ◆ Living environment (40 ± 6 marks)
- ◆ Earth's resources (40 ± 6 marks)
- ◆ Sustainability (40 ± 6 marks)

Skills, knowledge and understanding in each section	Paper 1 (application of environmental science)	Paper 2		Total				
		Section 1	Section 2					
Demonstrating knowledge and understanding of environmental science by making statements, describing information, providing explanations, and integrating knowledge.	10 ± 2	55 ± 5	20	85 ± 7				
Applying knowledge of environmental science to new situations, interpreting information, and solving problems.								
Planning and/or designing experimental/field work investigations to test given hypotheses or to illustrate particular effects.	10 ± 2	25 ± 2	0	35 ± 4				
Selecting information from a variety of sources.								
Presenting information appropriately in a variety of forms.								
Processing information/data (using calculations and units, where appropriate).								
Making predictions and generalisations based on evidence/information.								
Drawing valid conclusions and giving explanations supported by evidence/justification.								
Suggesting improvements to experimental/field work investigations.								
Total					20	80	20	120

Grade 'A' type marks

Approximately 30% of marks are designed to be grade 'A' type marks.

Administrative information

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History of changes

Version	Description of change	Date
2.0	Course support notes and question paper brief added as appendices.	June 2018
3.0	<p>Mandatory knowledge: the Forestry Commission has now been replaced with two organisations — Scottish Forestry and Forestry and Land Scotland.</p> <p>Assignment section, 'Resources' sub-section:</p> <ul style="list-style-type: none">◆ information added that there must be a range of topics available for candidates to choose from and that teachers/lecturers must minimise the numbers investigating the same topic within a class◆ teachers/lecturers can supply a basic list of instructions for the experimental procedure◆ candidates must undertake research using only websites, journals, books, and maps◆ information added to the bullet points about raw experimental data, internet/literature data and extracts◆ list of items that candidates cannot have access to in the report stage replaced with 'Candidates must not have access to a previously prepared draft of a report or any part of a report.' <p>Glossary: formula for the standard deviation of a population has been added.</p>	September 2019
3.1	<p>Scottish Natural Heritage (SNH) updated to NatureScot (NS) on page 10 and in course support notes. Historic reference to Forestry Commission Scotland removed on page 10.</p> <p>Hyperlinks checked, and updated where required. (pages 43 to 76)</p>	June 2021

Note: you are advised to check SQA's website to ensure you are using the most up-to-date version of this document.

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