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National Qualifications SPECIMEN ONLY

Mark

SQ15/H/01 Environmental Science

Date — Not applicable

Duration — 2 hours and 30 minutes

* S Q 1 5 H 0 1 *

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day Month Year

D D M M Y Y

Scottish candidate number

Total marks — 100

Attempt ALL questions.

Questions 10 and 11 each contain a choice.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not you may lose all the marks for this paper.

Total marks — 100

Attempt ALL questions

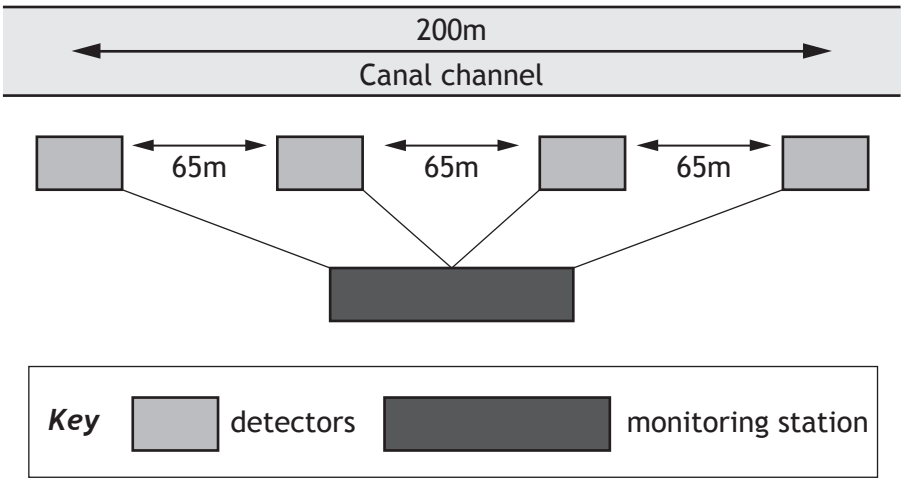
Questions 10 and 11 each contain a choice

MARKS | DO NOT WRITE IN THIS MARGIN

1. A survey of Scotland's bat populations was carried out along the re-opened canal system.

(a) Most bat species are nocturnal, feeding at night on insects that they detect by using echolocation. In echolocation, bats emit high frequency sounds that bounce off their surroundings. The bats then detect the echoes. These sounds can be detected by microphones, and each bat species can be identified from the distinctive pattern of frequencies that it emits.

Sound-detecting equipment was arranged as shown in the diagram below. Detectors were linked to a monitoring station that recorded the number of times a bat passed each detector. Identification of the bats was confirmed by observation using red torchlight or by capturing the bats in fine netting.



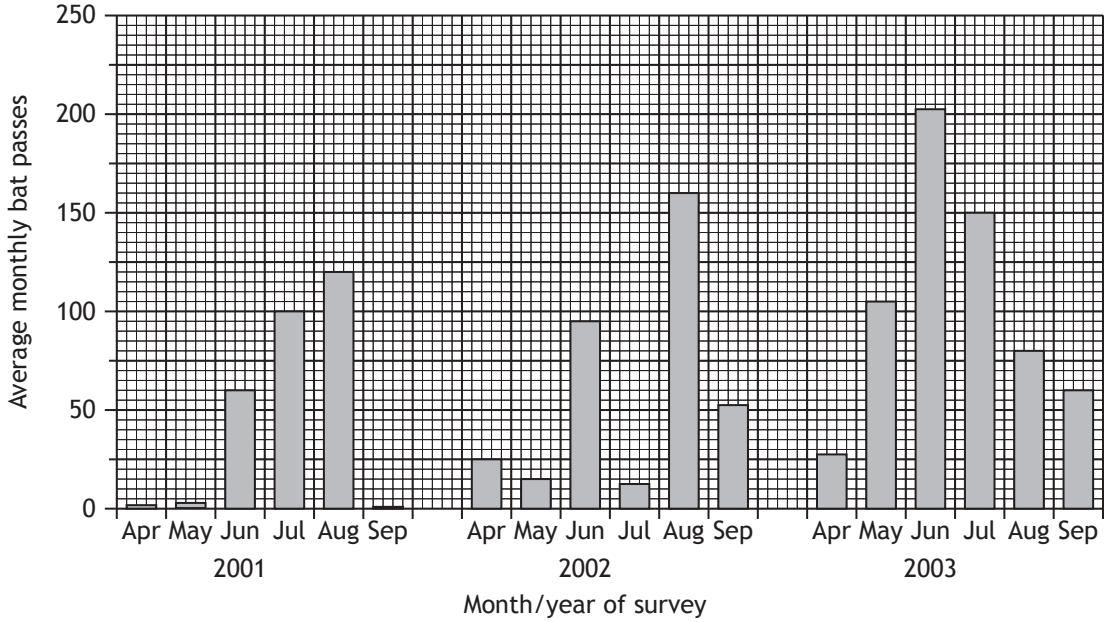
(i) State **one** qualitative sampling technique used in the survey. **1**

(ii) Describe **one** feature of the survey that increased its **reliability** and **one** feature that increased its **validity**. **2**

1. (a) (continued)

(iii) Suggest a reason why red torchlight was used to identify the bats in preference to using fine netting. **1**

(b) The graph below shows the average number of monthly bat passes per survey from 2001 to 2003.



(i) Describe **two** trends shown in the graph. **2**

(ii) Calculate, as a simple whole number ratio, the bat passes recorded during the month of August over the three year period. **1**

_____ : _____ : _____
2001 2002 2003

(iii) Explain how **one** abiotic factor could account for the fluctuations in numbers of bats recorded during the survey. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

2. The Scottish Government launched its Zero Waste Plan in 2010. This plan sets out to minimise resource use and production of waste.

(a) One of the aims of the Zero Waste Plan is to reduce the amount of food waste being sent to landfill.

Describe how food waste that is sent to landfill can contribute to the enhanced greenhouse effect. **1**

(b) Packaging is an issue associated with food waste. Much of the packaging is made from plastic.

Explain why it is important to reprocess plastics, in terms of resources. **1**

(c) Plastic food packaging can be recycled or reused.

Compare the environmental impacts of recycling with those of reusing plastic food packaging. **2**

(d) The table below shows annual figures for the recycling of plastic waste by local authorities in Scotland between 2006 and 2011.

Plastic waste recycled by local authorities in Scotland (tonnes)				
2006/07	*2007/08*	*2008/09*	*2009/10*	*2010/11*
12 083	14 715	16 996	21 588	26 316

Calculate the percentage increase in recycled plastic waste between 2006/07 and 2010/11. **1**

Space for calculation

2. (continued)

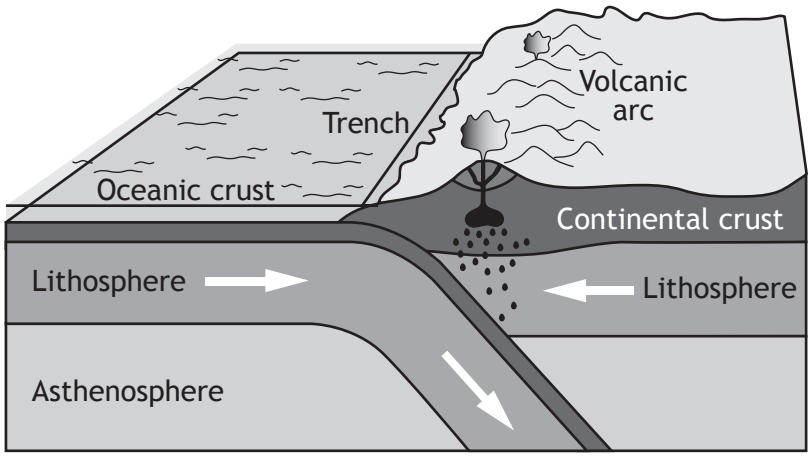
(e) The Zero Waste Plan supports the Waste (Scotland) Regulations 2012.

(i) Name the statutory agency that is responsible for enforcing the Waste (Scotland) Regulations 2012. **1**

(ii) Name **one** piece of waste management legislation that you have studied, other than the Zero Waste Plan and the Waste (Scotland) Regulations 2012, and describe **two** improvements it has made to the quality of life in Scotland. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

3. The diagram below illustrates a destructive plate boundary.



(a) (i) Describe how rising magma can result in the deposition of metallic minerals of economic value. **1**

(ii) Rocks at the Earth's surface are susceptible to weathering.

Describe the process by which mechanical weathering can speed up the rate of chemical weathering. **2**

3. (continued)

(b) The Earth's systems are in constant interaction.

(i) Explain how the hydrological cycle interacts with the rock cycle to create mineral deposits. **2**

(ii) Some of the Earth's largest deposits of lithium are found in tectonically active areas.

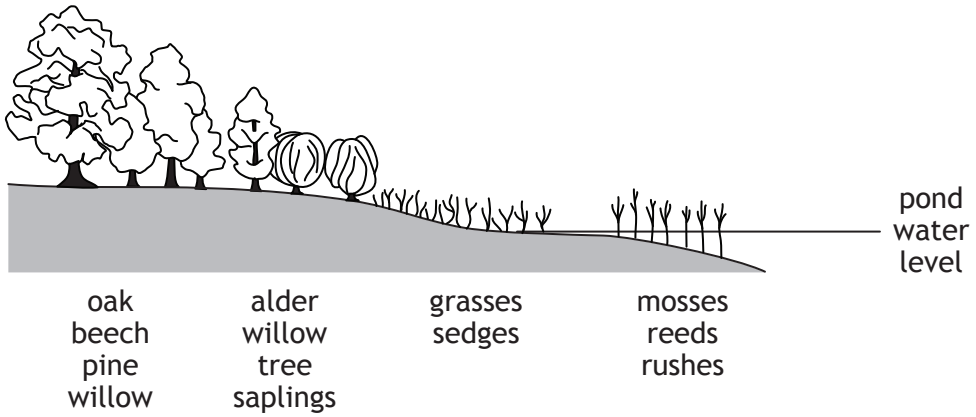
Explain why tectonically inactive areas are often home to resources more commonly associated with active plate margins. **2**

(iii) Soil is a product of the interaction between the Earth's systems.

Explain the importance of vegetation in the formation of soil. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

4. The diagram below shows an example of primary succession in and around a freshwater pond ecosystem.



(a) (i) State the meaning of the term "primary succession". **1**

(ii) Explain the changes in gross productivity that occur as succession proceeds. **2**

(iii) External factors can influence the natural sequence of succession.

Describe the sequence of changes in the plant communities that would occur as a result of draining the pond. **3**

4. (a) (continued)

(iv) State **one** way, other than draining the pond, in which this ecosystem could be managed to interrupt the sequence of natural succession. **1**

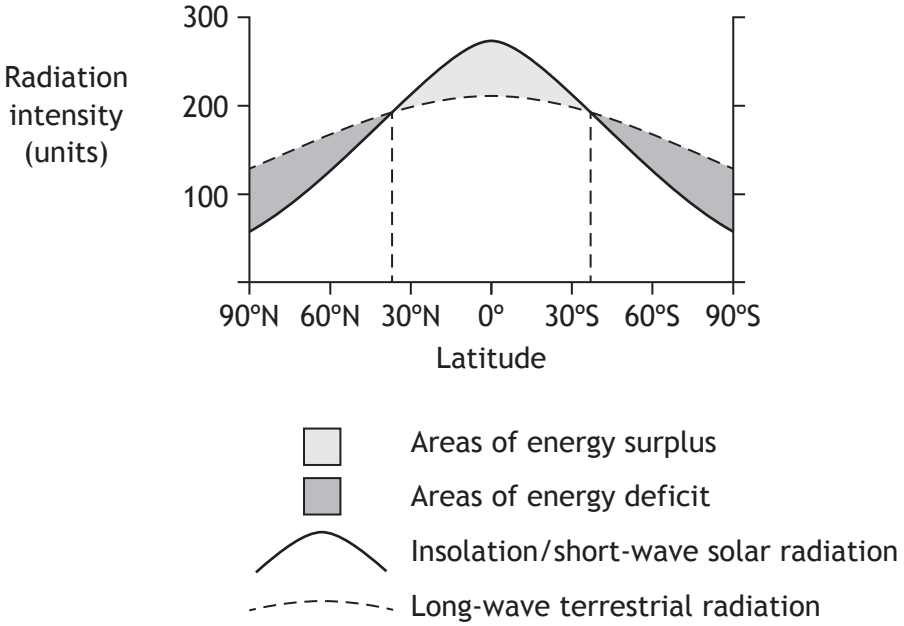
(b) The succession that is found in any given environment can be predicted.

Suggest **two** reasons for this. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

5. Solar energy is not equally distributed across the surface of the Earth.

The graph below shows that the area lying between the tropics receives a surplus of solar energy, while the areas towards the poles are in deficit.



(a) (i) Name the type of climate zone typically found at 25° south of the Equator. **1**

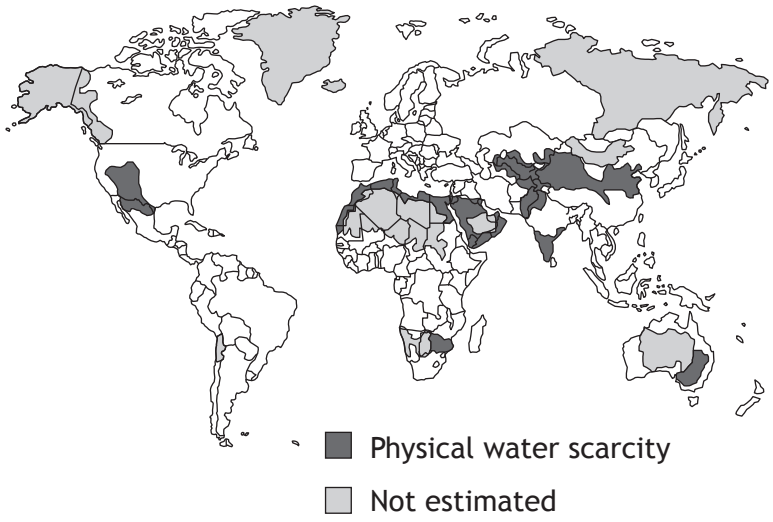
(ii) Describe **two** reasons for the solar energy deficit shown in the polar regions. **2**

(iii) Explain the redistribution of heat energy from areas of energy surplus to areas of energy deficit. Your answer should refer to the tri-cellular model. You may use a diagram in your response. **3**

5. (continued)

(b) The map below shows areas of physical water scarcity around the world.

Areas of Physical Water Scarcity



(i) Outline how atmospheric circulation influences the distribution of areas of physical water scarcity. **2**

(ii) Many of the areas in the World with physical water scarcity have large dam projects.

Explain how these water management approaches may increase water scarcity. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

6. The table below shows the preferred habitat requirements of some species of moorland birds.

Species	*Feeding preferences*	*Preferred height of heather for shelter or nesting (cm)*	*Preferred size of heather patches on moor*
Black grouse	heather, 20—30 cm in height	Above 30	Small
Golden plover	heather, less than 10 cm in height	Less than 10	Large
Twite	grass seeds and insects in grassland between heather patches	Above 15	Large
Merlin	small birds, eg twite	Less than 30	Small
Hen harrier	large birds, eg grouse, golden plover	Above 60	Small
Red grouse	heather, 10—30 cm in height	Above 25	Small

(a) (i) State which **two** species have the most similar habitat requirements. **1**

(ii) Construct a food web involving **five** species. **2**

(iii) Explain why the hen harrier prefers small heather patches. **1**

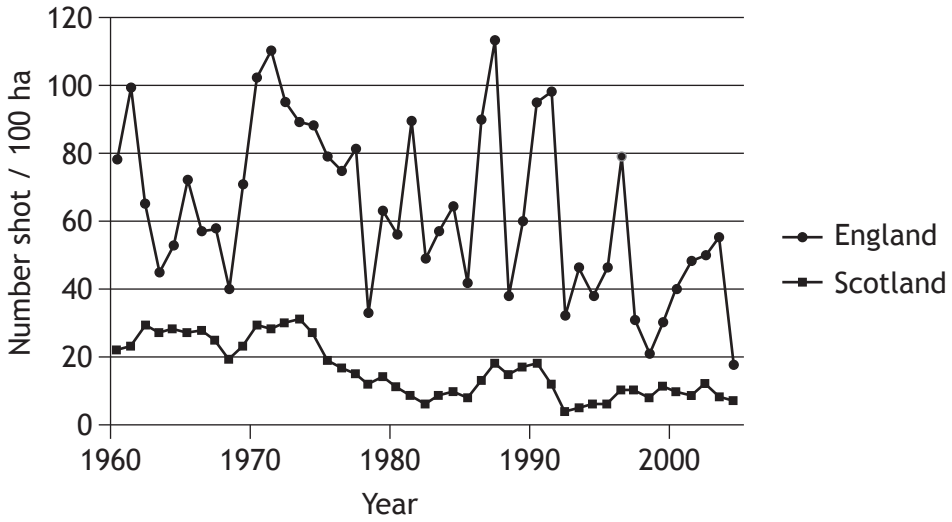
6. (continued)

(b) Moorland is often managed in order to sustain the largest possible population of red grouse for recreational shooting. The vegetation is burned on a rotational basis to create a patchwork of heather of different ages.

Explain why a patchwork of heather maximises red grouse numbers on a moorland and also increases biodiversity. **2**

(c) Grouse shooting is managed so that only birds that are surplus to the carrying capacity of the moorland are shot.

The graph below shows numbers of red grouse shot annually per 100 hectares (ha) on moorland estates in England and Scotland from 1961 to 2005.



(i) Compare the trends in the numbers of red grouse shot annually per hundred hectares in England and Scotland from 1961 to 2005. **2**

6. (c) (continued)

(ii) Suggest a reason to account for the trends in the numbers of red grouse shot annually per hundred hectares in England and Scotland from 1961 to 2005. **1**

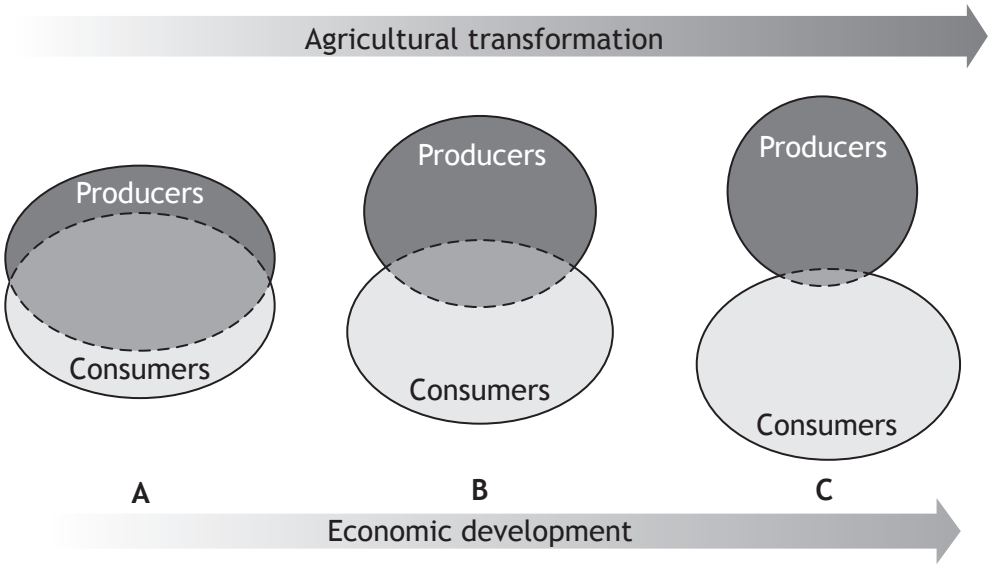
(iii) Red grouse are territorial animals. Mated red grouse defend an area of moorland that is suitable to meet the habitat requirements of themselves and their young. No other red grouse are tolerated within the territory.

Name the biotic factor of which this is an example and explain how this factor limits the population of red grouse on the moor. **2**

7. (a) The transition from subsistence farming to large-scale, commercial agriculture is largely linked to economic development.

MARKS DO NOT WRITE IN THIS MARGIN

The diagram below represents the interaction that exists between consumers and producers as agricultural transformation proceeds.



(i) Describe the trend in the relationship between consumers and producers as agricultural transformation proceeds. **1**

(ii) Explain the changes in interaction that occur between consumers and producers as agricultural transformation proceeds. **2**

(iii) Suggest **two** reasons why the interaction between consumers and producers may start to move closer together as agricultural transformation develops in the future. **2**

7. (continued)

(b) Strategies to increase food production may cause social and environmental impacts.

Describe **one** social and **one** environmental impact for a named food production strategy. **2**

8. Barley is Scotland's main arable crop. It is used in whisky distilling, brewing and food production.

Although there are many different varieties of barley, they fall into two main groups: spring barley (sown in December-April) and winter barley (sown in September/October).

(a) Abiotic factors, such as temperature and precipitation, affect growth of the barley crop. The table below shows the projected change in temperature and precipitation values for summer and winter by 2050 for different regions of Scotland.

Season	*Factor*	*Projected change*		
		West of Scotland	*East of Scotland*	*North of Scotland*
Summer	Mean temperature	2·4 °C	2·3 °C	2·0 °C
	Mean precipitation	−13%	−13%	−11%
Winter	Mean temperature	2·0 °C	1·7 °C	1·6 °C
	Mean precipitation	15%	10%	13%

(i) In summer the current mean precipitation for the west of Scotland is approximately 200 mm. Calculate a projected mean precipitation in **summer** for the west of Scotland by 2050. **1**

Space for calculation

(ii) Explain the impact that predicted changes to temperature and precipitation are likely to have on Scotland's **winter** barley crop. **2**

8. (continued)

(b) Name an edaphic factor and describe how this factor influences the rate of development of barley. **2**

(c) State a factor that a barley grower selling to the whisky industry would need to consider. **1**

MARKS | DO NOT WRITE IN THIS MARGIN

9. Water covers over 70% of the Earth's surface, but 97% of it is too salty to drink.

(a) (i) Name the process by which potable water can be extracted from seawater.

Explain **one** way in which this process is carried out. **3**

(ii) Salt is a by-product of the extraction process.

Explain why salt could have economic and adverse environmental impacts. **2**

(b) The table below shows levels of water withdrawal in 2006 around the world.

Continent	*Total water withdrawal by sector*						*Total water withdrawal km^3/year*
	Municipal		*Industrial*		*Agricultural*		
	km^3/ year	*% of total*	*km^3/ year*	*% of total*	*km^3/ year*	*% of total*	
Africa	28	13	11	5	175	82	214
Americas	135	16	295	35	409	49	839
Asia	228	9	244	10	2036	81	2508
Europe	72	22	188	56	73	22	333
Oceania	5	28	3	16	10	56	18

9. (b) (continued)

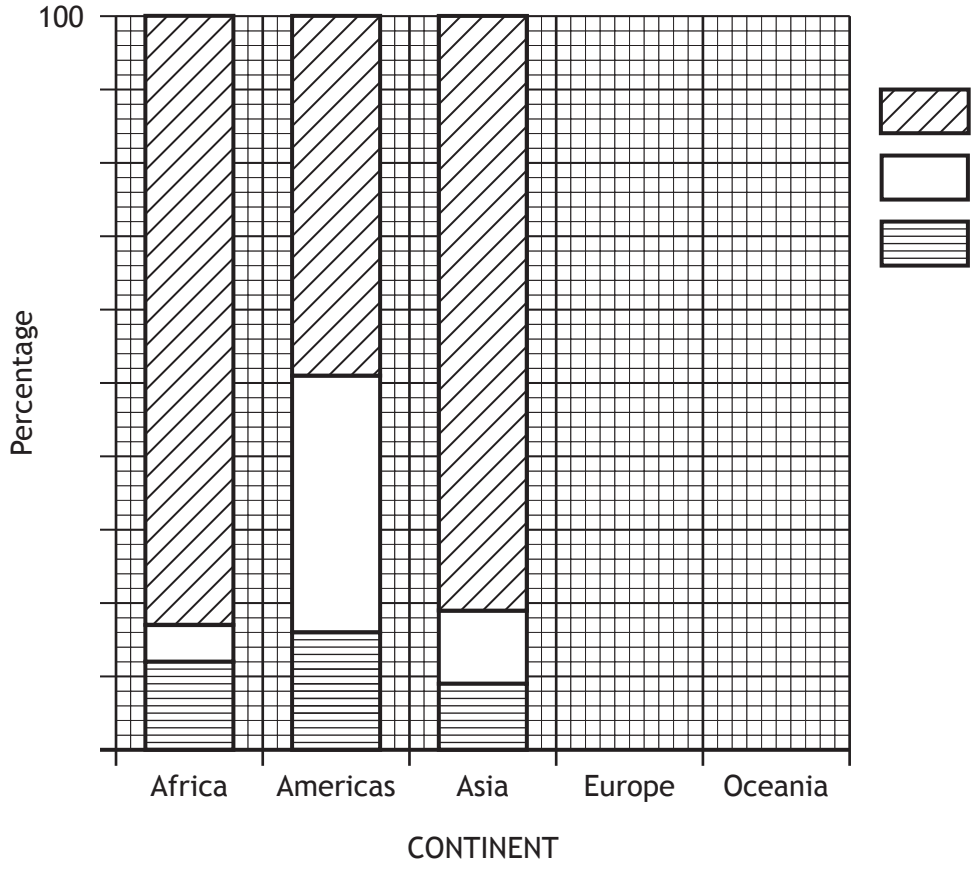
(i) Suggest a reason why the agricultural sector in Asia has the largest water withdrawal value in comparison to other continents. **1**

(ii) Calculate, as a percentage of the total water withdrawal, the water withdrawn for use by the industrial sector around the world. **1**

Space for calculation

(iii) The 100% stacked bar chart below shows the percentage of total water withdrawal by sector.

Use the information in the table to complete the bar chart and key. **2**



(Additional graph paper, if required, will be found on Page twenty seven.)

MARKS | DO NOT WRITE IN THIS MARGIN

10. Attempt **one** of the following questions.

Write your answer on the following pages.

A Global demand for food is rising because of population growth, increasing wealth, and changing diets. The United Nations has forecast that global food production will have to increase by 70% by 2050 to meet demand.

Discuss the potential impact of :

(a) One named strategy designed to increase land-based food production.

(b) One named strategy designed to increase aquatic food production. **10**

OR

B The greenhouse effect is believed by many experts to be the primary cause of global warming. Reducing the greenhouse effect can be achieved by taking steps to limit the emissions of greenhouse gases.

Discuss the potential impact of:

(a) One named energy taxation strategy designed to reduce greenhouse gas emissions.

(b) One named energy conservation strategy designed to reduce greenhouse gas emissions. **10**

SPACE FOR ANSWER

SPACE FOR ANSWER

MARKS | DO NOT WRITE IN THIS MARGIN

11. Attempt **one** of the following questions.

Write your answer on the following pages.

A The Earth's internal heat provides the mechanism for our dynamic planet, as it drives plate tectonics. This internal heat can be captured and exploited as a resource for human development.

Discuss the benefits and challenges of developing geothermal power as a reliable energy source. **10**

OR

B Biofuels are often hailed as alternatives to current hydrocarbon-based fuels. Agricultural land is now being given over to the growing of crops primarily for the generation of processed biofuels.

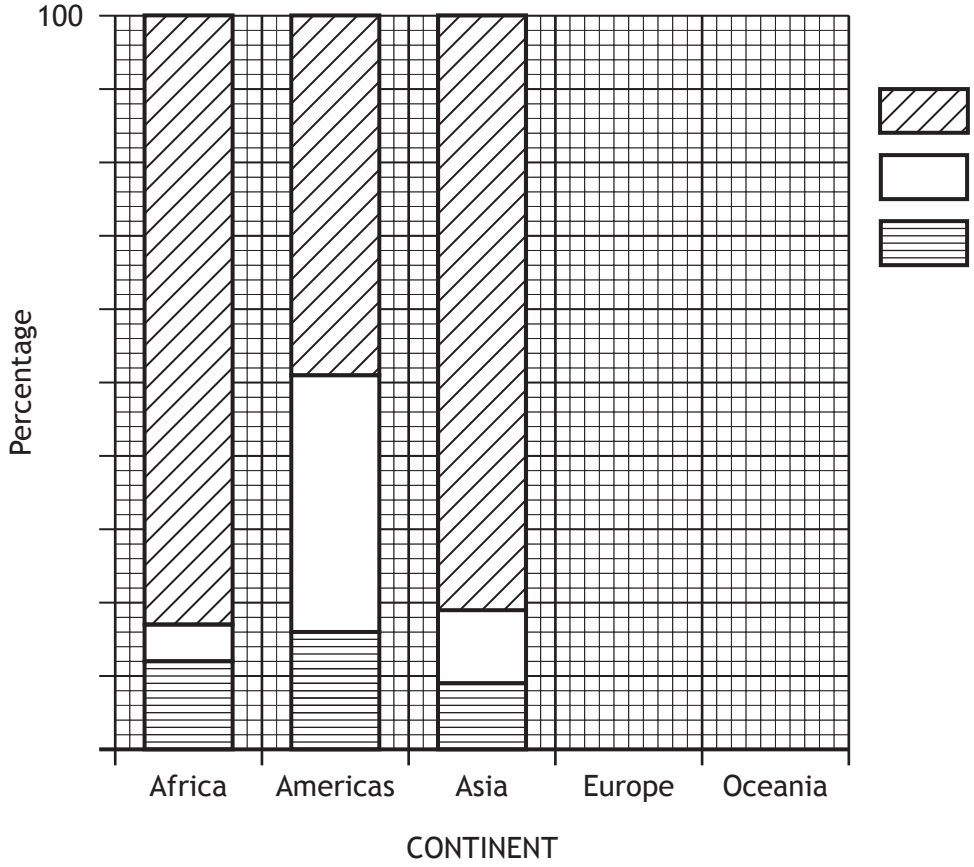
Discuss the benefits and challenges of processed biofuels as an alternative to processed hydrocarbon-based fuels. **10**

SPACE FOR ANSWER

SPACE FOR ANSWER

ADDITIONAL GRAPH PAPER FOR QUESTION 9 (iii)

MARKS DO NOT WRITE IN THIS MARGIN



[END OF SPECIMEN QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Acknowledgement of Copyright

Question 3 Illustration of a destructive plate boundary is adapted from US Geological Survey. Public Domain.

Question 6(c) Graph is adapted from www.gwct.org.uk. Reproduced by kind permission of Game & Wildlife Conservation Trust.

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SQ15/H/01 Environmental Science

Marking Instructions

These Marking Instructions have been provided to show how SQA would mark this Specimen Question Paper.

SQA ©

General Marking Principles for Environmental Science Higher

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) Half marks may not be awarded.

d) 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.

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

f) Larger mark allocations may be fully accessed whether responses are provided in continuous prose, linked statements or a series of discrete developed points.

g) In the detailed Marking Instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.

h) In the detailed Marking Instructions, words separated by / are alternatives.

i) If two answers are given where one is correct and the other is incorrect, no marks are awarded.

j) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.

k) The assessment is of skills, knowledge and understanding in Environmental Science, so marks should be awarded for a valid response, even if the response is not presented in the format expected. For example, if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested, give the mark.

l) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO_2, H_20) are acceptable alternatives to naming.

m) Content that is outwith the course assessment specification should be given credit if used appropriately eg metaphase of meiosis.

n) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, candidates should not be penalised repeatedly.

o) If incorrect **spelling** is used:
   - and the term is recognisable then give the mark;
   - and the term can easily be confused with another biological term then do not give the mark eg ureter and urethra;
   - and the term is a mixture of other biological terms then do not give the mark, eg mellum, melebrum, amniosynthesis.

p) When presenting data:

   - if a candidate provides two graphs or charts in response to one question (eg one in the question and another at the end of the booklet), mark both and give the higher mark

   - 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 give the mark(s) for this. Where provided, marks may still be awarded for correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used), etc.

   - the relevant mark should not be awarded if the graph uses less than 50% of the axes; if the x and y data are transposed; if 0 is plotted when no data for this is given (ie candidates should only plot the data given)

q) Marks are awarded 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;
- **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;
- **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.

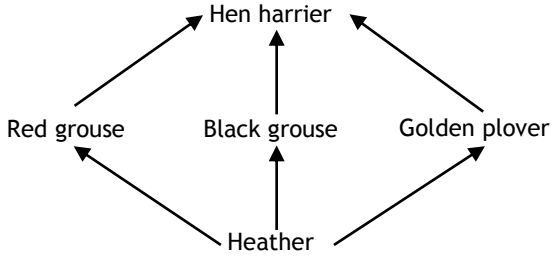
Marking Instructions for each question

Question			Expected response	Max mark	Additional guidance
1	**a**	**i**	Bat species identified from the sound frequencies emitted.	**1**	Key point is production of a species list (qualitative), rather than an estimate of actual numbers (quantitative).
1	**a**	**ii**	Reliability – several detectors used, increasing the data/number of records and Validity - identification of bats by two methods, confirming identification	**2**	One mark for each.
1	**a**	**iii**	Bats would be stressed by being netted and handled / a licence is required to handle bats / rabies shots are required before handling bats / ethics of capturing live animals / other reasonable response	**1**	Not bats are blind.
1	**b**	**i**	Overall number of passes increased from 2001 to 2003. and Extended range of activity / more passes early and late in the season from 2001 to 2003.	**2**	One mark for each.
1	**b**	**ii**	120 : 160 : 80 → 3 : 4 : 2	**1**	
1	**b**	**iii**	Abiotic – low temperature / high winds / heavy precipitation → food source unlikely to be flying, so bats unlikely to expend energy seeking them. or Other reasonable response.	**2**	One mark for named abiotic factor. One mark for influence of the named factor.
2	**a**		Decomposing food waste releases methane, which enhances the natural greenhouse effect. or Transportation of food waste to landfill releases carbon dioxide, which enhances the natural greenhouse effect. or Other reasonable response.	**1**	Answer should make mention of the enhanced greenhouse effect.

Question			Expected response	Max mark	Additional guidance
2	**b**		Plastic is made from crude oil, which is a finite resource. or Plastics sent landfill are a lost resource. or Plastics are harmful to the environment. or Other reasonable response.	**1**	Any one.
2	**c**		Reuse requires no reprocessing (other than cleaning) so saves on natural resources / reduces waste. and Recycling requires additional energy for reprocessing, transportation etc so contributes to emissions, but reduces waste overall. Other reasonable response.	**2**	Both required.
2	**d**		26316 – 12083 = 14233 14233 / 12083 × 100 = 117.8%	**1**	Candidates should be encouraged to show their working.
2	**e**	**i**	Scottish Environmental Protection Agency / SEPA	**1**	
2	**e**	**ii**	Landfill Directive / Waste Framework Directive / Environmental Protection Act 1990/ Landfill (Scotland) Regs / Special Waste Regs / WEEE Regs / other relevant piece of legislation. and All aim to improve quality of life via protection or improvement of land / air / water through reduction of pollution (visual, smell, noise, toxic), reduced emissions of CFCs, etc. and For example, the aim of the Landfill Directive is to prevent or minimise negative effects on the environment (particularly pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk	**3**	One mark for the named piece of legislation. One mark for each improvement.

Question			Expected response	Max mark	Additional guidance
			to human health.		
3	**a**	**i**	Heated water carrying dissolved minerals percolates through volcanic rock, and crystallises into deposits as the magma cools.	**1**	Response should include mention of volcanoes/magma and movement of mineral-bearing water.
3	**a**	**ii**	Mechanical weathering increases the exposed surface area, making it more susceptible to chemical weathering by water and air. or Other reasonable response.	**2**	One mark for mentioning increased surface area. One mark for mentioning agents of chemical weathering.
3	**b**	**i**	Some minerals form in water, others are formed from weathering interactions between the atmosphere and hydrosphere. or Other reasonable response	**2**	One mark for hydrological cycle role. One mark for rock cycle role.
3	**b**	**ii**	Crustal plate movement is dynamic. and Ancient plate boundaries in areas now tectonically inactive may be home to minerals originally associated with subduction zones.	**2**	One mark for dynamic nature of plate movement and one mark for explanation.
3	**b**	**iii**	Decomposition of plants provides organic matter or decomposition of OM provides nutrients or decomposition of OM supports soil biota or plant roots bind soil particles and reduce soil erosion and run-off or plant roots aid aeration and drainage or vegetation type influences edaphic factors or other reasonable response	**3**	Up to three responses. One mark for each role of vegetation.

Question			Expected response	Max mark	Additional guidance
4	**a**	**i**	A sequence of changes that takes place in an environment that is devoid of vegetation and soil.	**1**	
4	**a**	**ii**	Gross productivity increases because there is an increase in biomass AND variety of plants. Other reasonable response.	**2**	One mark for mentioning biomass. One mark for mentioning variety.
4	**a**	**iii**	Mosses, reeds and rushes would die out and Pond would be taken over by primary colonisers / grasses and sedges would colonise original pond edge. and Willow and saplings would spread over the area followed by the spread of oak etc which would form the climax community. or Pioneer stages → intermediate stages → climax community, with named examples.	**3**	One mark for saying existing vegetation would die out. One mark for finishing with the climax community. One mark for intermediate stage or mention of competition for resources / changes in edaphic conditions.
4	**a**	**iv**	Dredging the pond / removal of vegetation from edge of the pond / cutting down trees / deforestation / grazing / other reasonable response.	**1**	Any one.
4	**b**		Edaphic/soil/geological/climatic factors limit the species that are able to survive. or The surrounding communities provide a limited seed source.	**2**	Any two.
5	**a**	**i**	Hot desert	**1**	
5	**a**	**ii**	Albedo of snow and ice / seasonality (3 months of no solar input beyond 60^{o}N or 60^{o}S) / curvature of the Earth means incoming energy has greater surface area to heat / incoming energy in polar regions travels at an angle due to curvature of the Earth, increasing possibility of reflection/absorption	**2**	Any two.
5	**a**	**iii**	Tri-cellular model should include mention of Hadley, Ferrel and Polar cells.	**3**	An annotated diagram could gain full marks.

Question			Expected response	Max mark	Additional guidance
			and Explanation of how a parcel of air can move via these cells from the Equator to a pole (and vice versa), redistributing heat/cold across the Earth's surface.		Credit should be given for correct consideration of areas of high and low pressure / jet streams.
5	**b**	**i**	Areas of water scarcity correspond with high pressure belts (formed by the tri-cellular model), resulting in low precipitation. or Other reasonable response.	**2**	One mark for mention of pressure belts. One mark for impact on precipitation.
5	**b**	**ii**	Large dams result in large reservoirs with large surface areas, so increasing evaporation into the atmosphere and seepage into the soil/groundwater. or Irrigation channels and canals to transport water also result in increased evaporation from the system.	**2**	One mark for mention of increased loss of water from evaporation / seepage or throughflow. One mark for linking this to the water management scheme. Candidates may refer to case studies.
6	**a**	**i**	Red grouse and black grouse	**1**	Both for one mark.
6	**a**	**ii**		**2**	One mark for 5 correct species. One mark for correct use of arrows.
6	**a**	**iii**	Small heather patches are preferred by two of its prey species.	**1**	
6	**b**		Red grouse need different ages of heather for different functions. and A patchwork of heather provides an increased range of habitats or variety of niches → it suits a greater range of species. or Other reasonable response.	**2**	One mark for mention of grouse needing heather of different ages. One mark for mention of increased range of habitats/niches supporting a greater range of species.

Question			Expected response	Max mark	Additional guidance
6	**c**	**i**	The numbers shot per 100 ha each year are falling in both England and Scotland. or The numbers shot per 100 ha in England are getting closer to the numbers shot in Scotland. or Greater annual variation in number shot in England than in Scotland but overall trend for both is decreasing. or Other reasonable response.	**2**	Response must mention BOTH England and Scotland. Data refer to numbers shot/100 ha rather than absolute populations.
6	**c**	**ii**	The breeding success is reducing so there is less surplus to shoot. or Breeding success is falling faster in England (than in Scotland). or Changes in climatic conditions / the number of people shooting / social attitudes / levels of sheep farming. or Other reasonable response.	**1**	Any one.
6	**c**	**iii**	Intra-specific competition. and It prevents overpopulation by excluding non-territorial birds / other reasonable response.	**2**	One mark for stating intra-specific competition as the biotic factor. One mark for explanation of the behaviour.
7	**a**	**i**	As agricultural transformation proceeds interaction between producers and consumers reduces / number of consumers remains static but number of producers decreases / other reasonable response.	**1**	Any one.
7	**a**	**ii**	Subsistence farmers grow food for their own needs and have little surplus to sell. They are both producers and consumers. or As agricultural transformation proceeds the focus is on maximising yield and the interaction between producer and consumer	**2**	Discussion of at least **two** of the stages. One mark for each.

Question			Expected response	Max mark	Additional guidance
			decreases. Or Commercial farmers seek maximum yield for local/national/international markets. or Other reasonable response.		
7	**a**	**iii**	Raised awareness of green credentials / need to reduce pollution, soil degradation, nutrient loss, erosion, water use, carbon footprint, natural resource use, consumer demand, food miles / need to increase biodiversity, food security / other reasonable response. For example, reducing food miles will require sourcing of food closer to home and may change consumer shopping habits eg away from supermarkets towards local suppliers, or a move back towards seasonal consumption.	**2**	Any two. Focus should be on awareness of adverse impacts and the potential benefits of closer ties between food production and consumption.
7	**b**		Social – agricultural development often results in movement of people off the land, with loss of livelihood/jobs/means to support themselves. and Environmental – increasing agricultural yields requires input of fertiliser/pesticides and use of heavy machinery. Other reasonable response(s).	**2**	One mark for social impact. One mark for environmental impact.
8	**a**	**i**	200 × 13/100 = 26 200 – 26 = 174 mm	**1**	
8	**a**	**ii**	Overall there is an increase in temperature (1·6-2 °C) and precipitation (10-15%) in the winter months. Warmer winter temperatures would potentially extend the growing season, but increased precipitation could affect the soil structure and nutrient content. This would impact on yield. or Warmer, wetter conditions could better suit a wider range of pest species, including weeds,	**2**	One mark for explaining the impact of increased temperature on the winter barley crop. One mark for explaining the impact of increased precipitation. Candidates must make reference to the predicted values in their responses.

Question			Expected response	Max mark	Additional guidance
			which would out-compete the winter barley. or Other reasonable response.		
8	**b**		Soil temperature / nitrogen content / moisture / pH / oxygen / soil structure / other reasonable response. eg germination is driven by adequate soil moisture, temperature and oxygen content.	**2**	One mark for naming edaphic factor. One mark for description of how it affects rate of plant development.
8	**c**		Malting barley for distilling requires a lower nitrogen level (1·5-1·65% nitrogen) than malting barley for brewing (1·6-1·85%). Other reasonable response.	**1**	
9	**a**	**i**	Thermal distillation – involves boiling saline water and collecting the purified vapour/distillate. or Reverse osmosis – involves filtration of saline water. or Other reasonable response	**3**	One mark for name of process. Two marks for appropriate explanation of the named process.
9	**a**	**ii**	The salt will usually be in the form of brine, which may also contain chemicals and residues from the extraction process. These will have a negative environmental impact if discharged onto the land. or Desalination brine is usually discharged into the sea. Is denser than seawater → saltier layer near the outflow than in surrounding sea → negative impacts on coastal and marine life → need to locate outflow in areas where brine will be dispersed quickly eg strong tidal current. or Inland desalination plants cannot discharge salt into freshwater courses → must be transported to a disposal point which will not pollute freshwater → storage and	**2**	One mark for an adverse environmental impact. One mark for an economic impact – positive or negative. Desalination technology and handling/treatment of waste will change in the face of increasing demand for water versus minimising environmental impacts. Give credit where appropriate.

Question			Expected response	Max mark	Additional guidance
			transportation issues. and Methods → separation of brine into salt and (distilled) water → water can be discharged into freshwater watercourses, salt can be purified for industrial use or human consumption. or Other reasonable response.		
9	**b**	**i**	The data suggests that Asia has a very high population compared with other continents, which will need to be fed →increased demand for water for agriculture. or The agricultural system is heavily water-dependent eg rice production requires flooding of fields (rice paddies). Other reasonable response.	**1**	Any one.
9	**b**	**ii**	Total industrial withdrawal = 741 km^3/year Total water withdrawal = 3912 km^3/year 741 / 3912 x 100 = 18·9%	**1**	
9	**b**	**iii**	y-axis scale should range from 0-100 AND should be labelled appropriately (%). 100% stacked bars should be correctly drawn for Europe and Oceania and key should be completed.	**2**	One mark for appropriate y-axis scale (must include zero) and label. One mark for correctly drawn 100% stacked bars (drawn with a ruler) and key completed.
10	**A**		One land-based strategy and one aquatic strategy. For each strategy: • Name of the strategy **1 mark** • description of named strategy **1 mark** • Potential impact **1 mark** for each well-structured statement. Up to 4 marks in total For example: • **Name of strategy** — Use of pesticides,	**10**	If a candidate is to achieve max marks they must have named the strategy, given a description of the strategy AND discussed the potential impacts. Statements should be well structured and candidates should be advised not to use bullet points. Maximum of 6 marks for land-based strategy.

Question			Expected response	Max mark	Additional guidance
			1mark • **Description of strategy** — Pesticides are manufactured chemicals that are designed to kill unwanted animals/insects. Rodenticide is a an example that is used to kill rats and mice. **1 mark** **Potential Impacts** • Positive impacts — less contamination of harvested crop increases profitable yield, less contamination prevents spread of disease. **1 mark each** • Negative impacts — decomposition of dead animals, potential for bioaccumulation of pesticides in predators / biomagnification of pesticides through the food chain **1 mark each** • Other reasonable responses.		Maximum of 6 marks for aquatic-based strategy. The description and potential impacts should relate to the named strategy, which could be selected from the following. Land-based food production: • Mechanisation • Agrochemicals • Irrigation • Land management • Genetic engineering • GM crops • High yield varieties • Selective breeding • Hydroponics Aquatic based food production (aquaculture): • High density cages • Pesticides • Selective breeding • GM crops • Hormone use • Marine fishing The same named example should <u>not</u> be covered for both land-based and aquatic strategies.
10	**B**		One energy taxation strategy <u>and</u> one energy conservation strategy. Response for each part should include: • Name of the strategy **1 mark** • description of named strategy **1 mark** • Potential impact **1 mark** for each well-structured statement. Up to 4 marks in total. For example: • **Name of taxation strategy** — Scottish Renewables Obligation **1 mark** • **Description of strategy** — SRO encourages	**10**	If a candidate is to achieve max marks they must have named the strategy, given a description of the strategy AND discussed the potential impacts. Statements should be well structured and candidates should be advised not to use bullet points Maximum of 6 marks for energy taxation. Maximum of 6 marks for energy conservation. The description and potential

Question			Expected response	Max mark	Additional guidance
			energy suppliers to source increasing amounts of electricity from renewable sources. **1 mark** **Potential impacts** • Positive impacts less carbon/greenhouse gas emissions in production of electricity, suppliers can trade renewable obligation certificates to other businesses. **1 mark each** • Negative impacts to supplier: difficulty in achieving target set by the government, must obtain ROC from elsewhere or be fined. **1 mark each** • Other reasonable responses. For example: • **Name of energy conservation strategy** — Green Deal **1 mark** • **Description of strategy** — Government initiative designed to help consumers to install more green technology in their properties **1mark** • **Positive impacts** — occupiers spend less money on heating buildings, no upfront costs for installation but spread over time **1 mark each** • **Negative impacts** — installation costs stay with the property when sold, must go through a Green Deal provider and be assessed. **1 mark each** • Other reasonable responses		impacts should relate to the named strategy, which could be selected from the following (or any other relevant strategy). Energy taxation: • Climate change levy • CRC Energy Efficiency Scheme • Emissions trading / EU Emissions Trading System (EU ETS) • (Scottish) Renewables Obligation • Landfill Tax • Fuel duty • Vehicle Excise Duty Energy conservation: • Energy Company Obligation (ECO) • UK/Scottish Energy Efficiency Strategy • Green Deal • Heat and Energy Saving Strategy • UK Low Carbon Transition Plan • UK/Scottish Renewable Energy Strategy • Climate Change Delivery Plan • Industry/business strategies • Personal strategies eg energy efficiency measures in the home, use of smart meters etc.
11	**A**		Show understanding of key terms 'geothermal and 'renewable/non-renewable energy source' **Benefits** • Geothermal energy is a renewable source	**10**	If a candidate is to achieve max marks they must include benefits and challenges. Maximum of 7 marks for either benefits or challenges. The discussion of

Question			Expected response	Max mark	Additional guidance
			reducing reliance on finite carbon-based sources of energy. • Geothermal energy is a clean source reducing CO_2 emissions and carbon footprint of countries. • The visual impact of geothermal plants is less than that of coal fired plants. • Geothermal energy provides a source of energy security for countries where available, so consumer prices should be more stable over longer term. • Geothermal plants can be large or small scale. • Geothermal plants are less susceptible to contributing pollution in the event of natural disasters. **Challenges** • Limitations on location of plants – the plants need to be located in areas of geothermal activity – which reduces potential distribution. • Geothermal sources can be hazardous. • Plants have limited output. For many countries/regions, this would have to be part of an 'energy mix' including other sources. • Cost of distribution will vary as geothermal sources are not always located near urban areas, which are the main market.		benefits/challenges should relate to geothermal energy. Answers that are purely descriptive in nature should gain no more than 4 marks.
11	**B**		Show understanding of key terms 'processed biofuel' and 'processed carbon based fuels'/'non-renewable energy source'. **Benefits:** • Biofuels have the potential to minimise CO_2 emissions by generating energy not reliant on hydrocarbons. • Could provide economic stability in energy prices in times of diminishing hydrocarbon resources. • Biofuels could provide a limited source of energy security for countries where available, so that countries rely less on imports of hydrocarbons. • High yield crops grown in small areas could combat socio-economic and environmental	**10**	If a candidate is to achieve max marks they must include benefits and challenges. Maximum of 7 marks for either benefits or challenges The discussion of benefits/challenges should relate to processed biofuels. Answers that are purely descriptive in nature should gain no more than 4 marks.

Question			Expected response	Max mark	Additional guidance
			concerns. **Challenges:** • Do not necessarily mitigate against anthropogenic climate change. • Deforestation to create farmland for growing biofuel crops can create environmental imbalance; deforestation itself also contributes to the enhanced greenhouse effect. Burning adds carbon dioxide to atmosphere. Fewer trees means less carbon dioxide absorption/sequestration. • High yield crops require high levels of artificial fertiliser, creating soil pollution. • Socio-economics of food vs fuel, particularly in ELDCs where there are poverty and food issues. • Increased food prices due to diversion of crops to ethanol generation.		

[END OF SPECIMEN MARKING INSTRUCTIONS]