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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

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.

SQA ©

* S Q 1 5 H 0 1 *

Total marks — 100

Attempt ALL questions

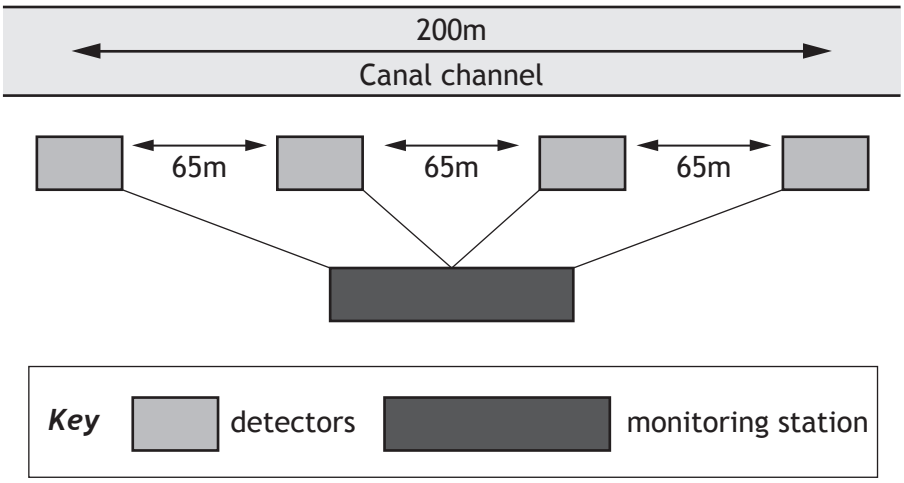
Questions 10 and 11 each contain a choice

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.



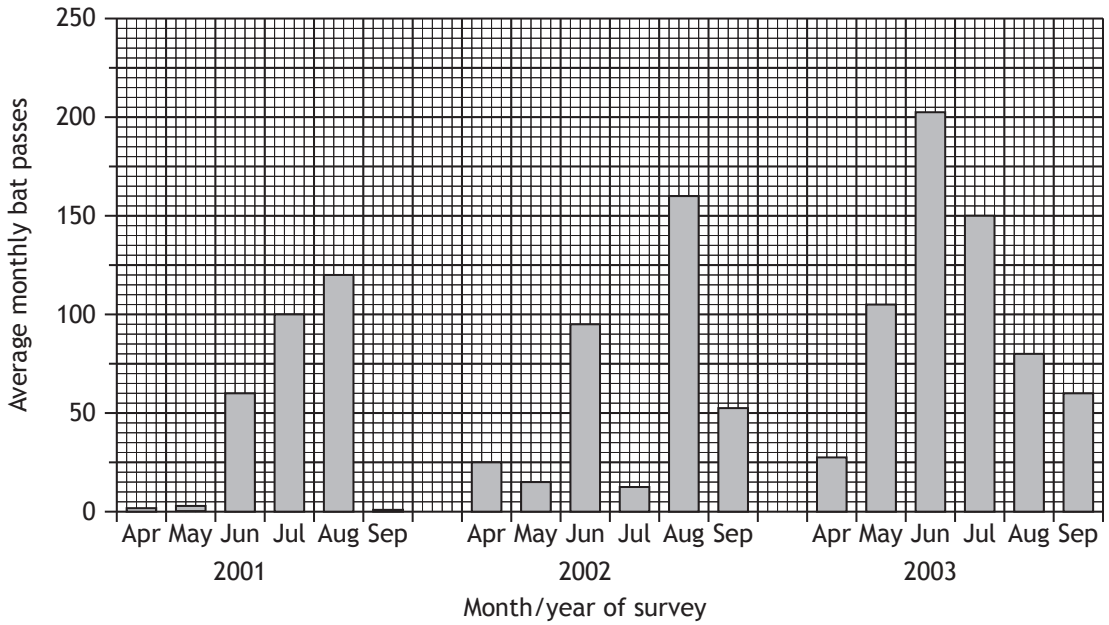
(i) State **one** qualitative sampling technique used in the survey. **1**

(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)

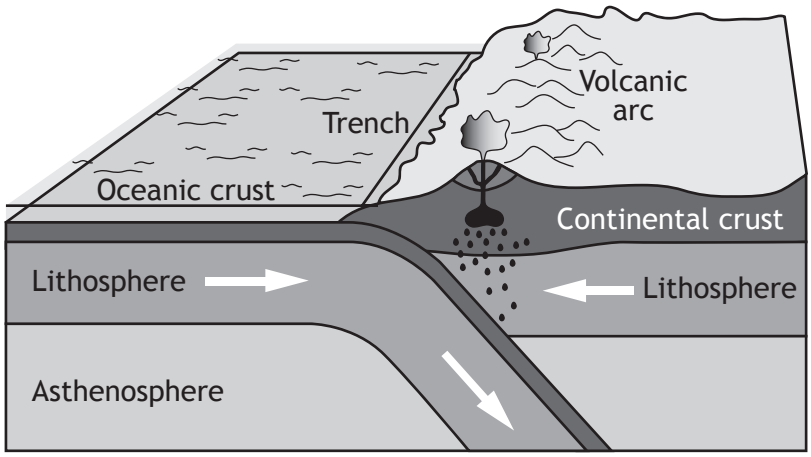
(e) The Zero Waste Plan supports the Waste (Scotland) Regulations 2012.

(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.

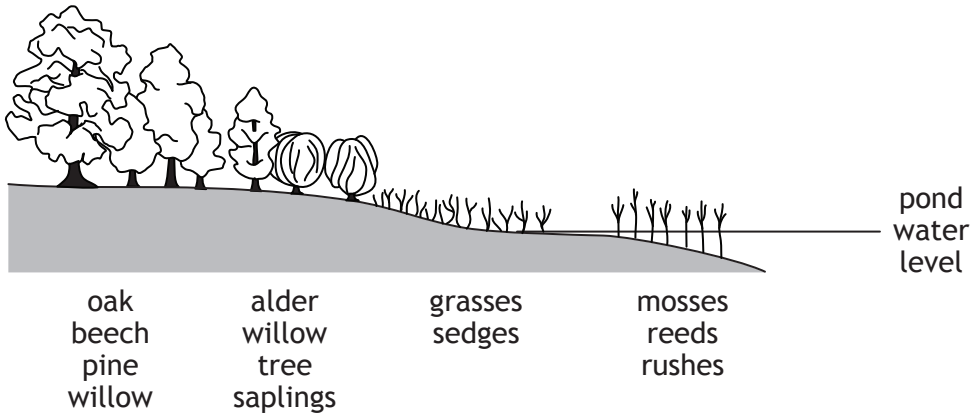
Explain why tectonically inactive areas are often home to resources more commonly associated with active plate margins. **2**

(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**

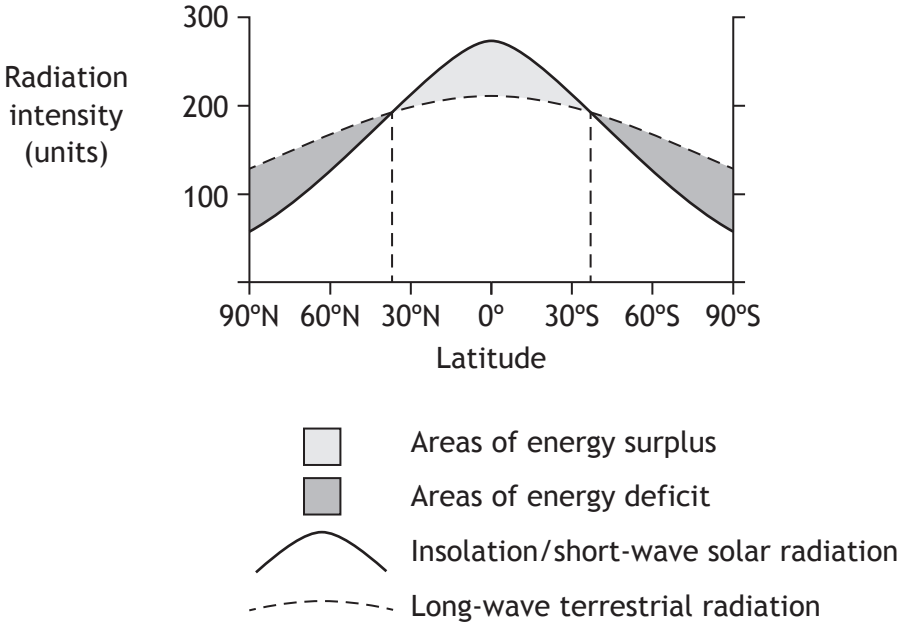
(b) The succession that is found in any given environment can be predicted.

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**

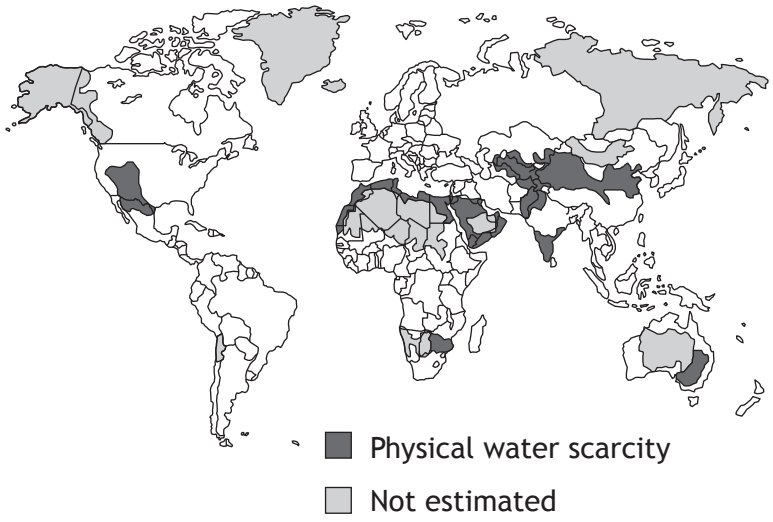
(ii) Describe **two** reasons for the solar energy deficit shown in the polar regions. **2**

(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**

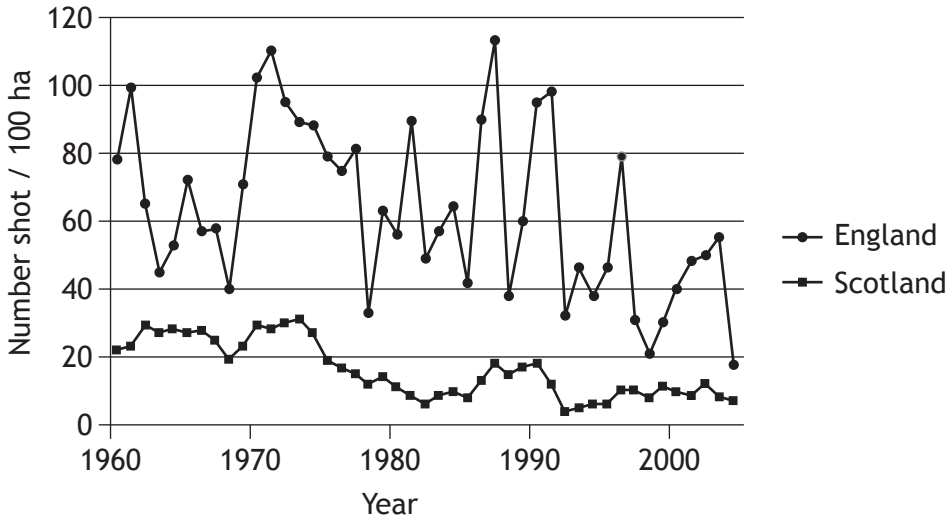
6. (continued)

(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**

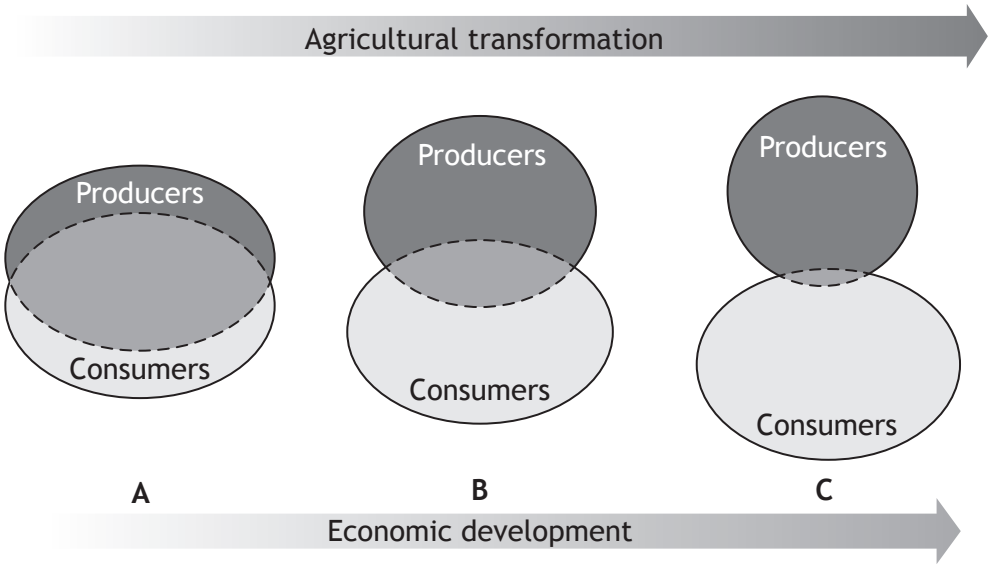
(iii) Red grouse are territorial animals. Mated red grouse defend an area of moorland that is suitable to meet the habitat requirements of themselves and their young. No other red grouse are tolerated within the territory.

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)

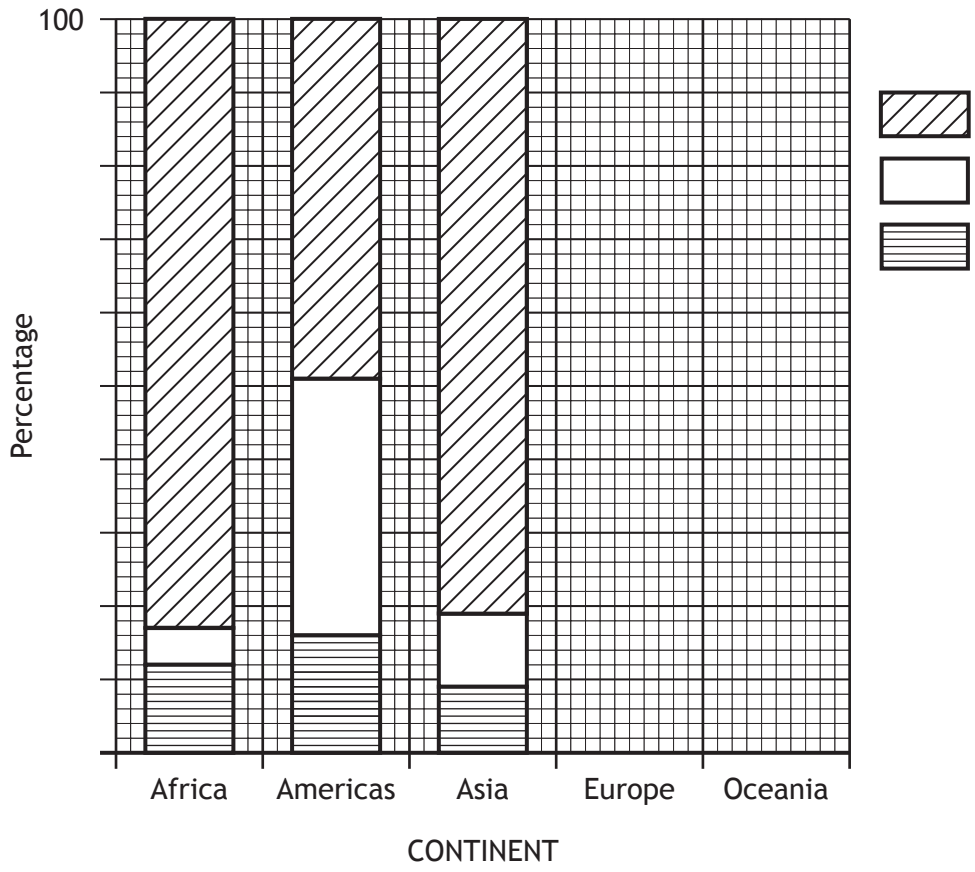
(i) Suggest a reason why the agricultural sector in Asia has the largest water withdrawal value in comparison to other continents. **1**

(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.

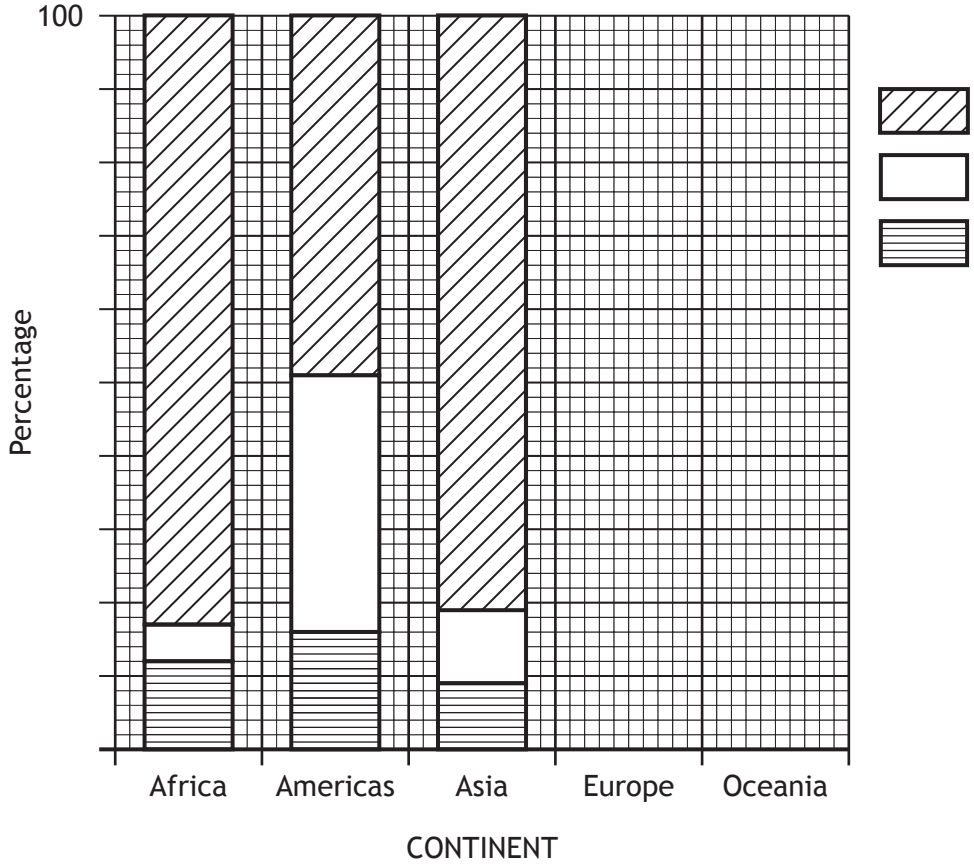
Discuss the benefits and challenges of processed biofuels as an alternative to processed hydrocarbon-based fuels. **10**

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

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