FOR OFFICIAL USE

N5

National Qualifications 2025

Mark

X826/75/01 Environmental Science

WEDNESDAY, 28 MAY
9:00 AM – 11:30 AM

X8267501

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 marks

SECTION 1 — 66 marks
Attempt ALL questions.

SECTION 2 — 20 marks
Attempt ALL questions.

SECTION 3 — 14 marks
Questions 9 and 10 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 ©

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SECTION 1 — 66 marks

Attempt ALL questions

1. Woodlice are detritivores, commonly found living amongst leaf litter.

(a) Define the term *detritivore*. **1**

(b) (i) Describe a named sampling technique that could be used to sample woodlice. **3**

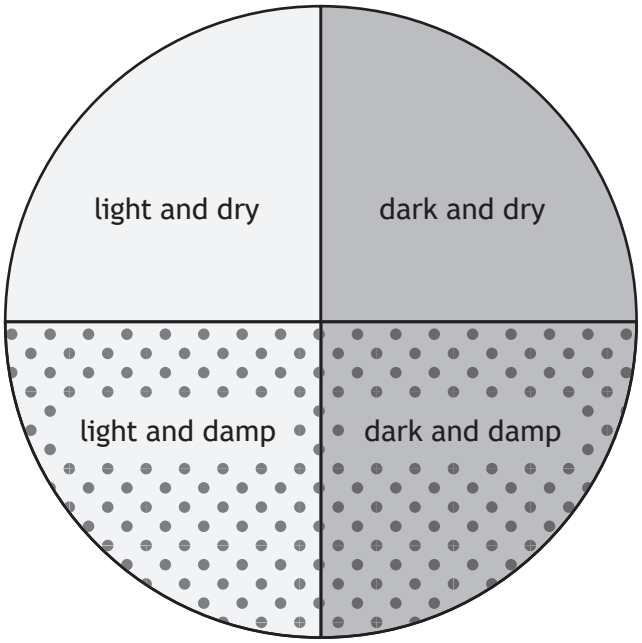
Technique

Description

(ii) Explain one potential source of error for your chosen technique. **2**

1. (continued)

(c) A group of students collected 15 woodlice and placed them in the apparatus represented by the diagram.



(i) Name the apparatus represented by the diagram. **1**

(ii) Suggest a suitable aim for the investigation. **1**

[Turn over

1. (c) (continued)

(iii) After 10 minutes, the number of woodlice in each section was recorded. The results are shown in the table.

Section	Light and dry	Light and damp	Dark and dry	Dark and damp
Number of woodlice	0	1	2	12

The students concluded that woodlice prefer dark and damp conditions.

(A) Calculate the percentage of woodlice found in the dark and damp section. **1**

Space for calculation

(B) Suggest one reason why woodlice may prefer habitats with dark and damp conditions. **1**

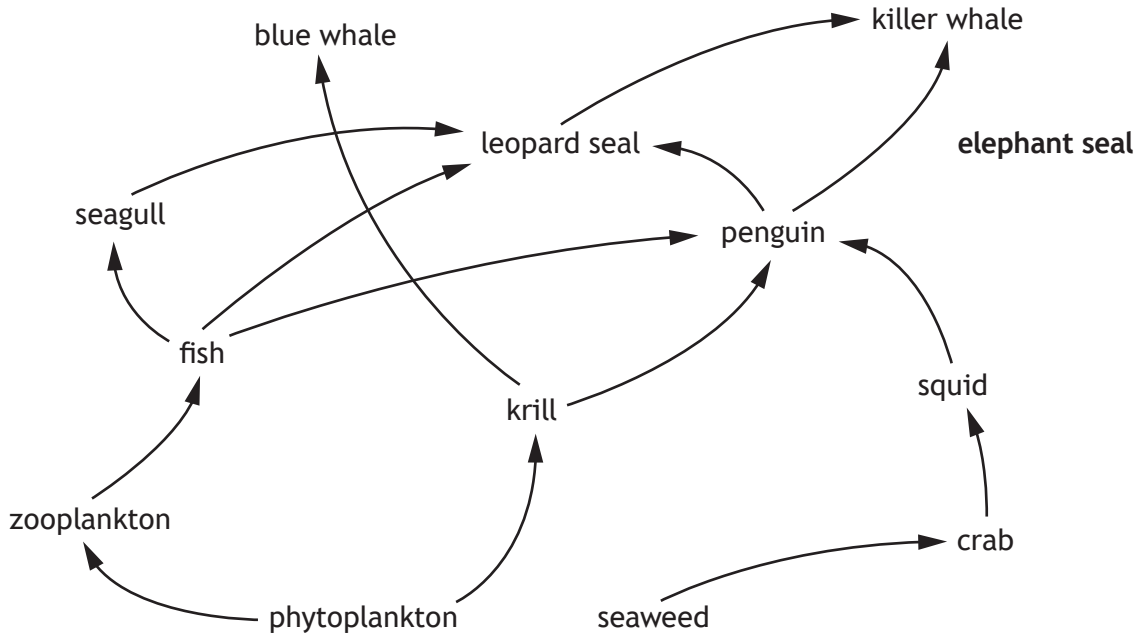
(iv) Other than repeating the experiment several times and calculating a mean, suggest how the students could have increased the reliability of their results. **1**

[Turn over for next question

DO NOT WRITE ON THIS PAGE

2. (a) The diagram shows the feeding relationship between some organisms in an ecosystem in Antarctica.

The diagram is not complete.



(i) State the term given to the diagram above that shows the feeding relationships between organisms in an ecosystem. **1**

(ii) The elephant seal is a predator of the squid and crab. It is also prey of the killer whale.

Complete the diagram above by adding arrows to show these feeding relationships. **1**

(iii) Disease would reduce the population of the leopard seal.

Explain the impact this may have on the population of the elephant seal. **1**

2. (continued)

(b) There are several species of penguin in Antarctica. Information about some of the penguin species is shown in the table.

Penguin species	Adult height range (cm)	Foot colour	Beak colour	Facial feathers
Adélie	40–70	pink	black	all black, flat
Chinstrap	68–76	pink	black	black and white, flat
Gentoo	50–90	orange	orange and black	black and white, flat
King	90–100	black	yellow and black	black and yellow, flat
Rockhopper	45–52	pink	orange	black and yellow, projecting

(i) Using the information from the table, complete the paired statement key. **2**

1. Foot colour pink — go to 2
   Foot colour not pink — go to 3
2. Beak colour orange — Rockhopper
   Beak colour black — go to 4
3. Facial feathers black and white — _____
   Facial feathers black and yellow — _____
4. _____ — Adélie
   _____ — Chinstrap

(ii) From the information provided in the table, describe one similarity and one difference between the Adélie penguin and the Gentoo penguin. **2**

Similarity _____

Difference _____

3. Visitor numbers to seaside resorts in the United Kingdom (UK) increased significantly during and after the COVID-19 pandemic.

(a) Describe one environmental and one economic benefit of UK residents holidaying in the UK, rather than travelling to foreign destinations. **2**

Environmental

Economic

3. (continued)

(b) A popular activity during seaside holidays is building sandcastles, using plastic buckets and spades. The plastic buckets and spades are often left behind by holidaymakers.

Approaches to reducing, reusing, and recycling this plastic waste have been suggested by local councils.

(i) Describe one difference between the reusing and recycling of waste products. **1**

(ii) One suggestion is to clean the plastic and use the material as part of a competition in local schools. This will involve creating artwork about the rights and responsibilities of people around the world.

State the term used to describe an awareness of these rights and responsibilities. **1**

(iii) This competition also aims to raise awareness of the seventeen sustainable development goals (SDGs).

Name the organisation responsible for the development, adoption, and support of the SDGs. **1**

(iv) Suggest one other way that local councils could reduce the number of plastic buckets and spades sent for recycling or to landfill. **1**

[Turn over

3. (continued)

(c) It is estimated that 400 million tonnes of plastic is produced globally each year. Only 15% of this plastic is reused or recycled.

(i) Calculate the mass of plastic which is **not** reused or recycled. **1**

Space for calculation

(ii) A process has been developed to reduce the amount of plastic sent to landfill sites.

The plastic is combined with carbon dioxide to form a product, which is then used to make alternative fuels.

Explain why this process may be considered an example of a sustainable development. **2**

[Turn over for next question

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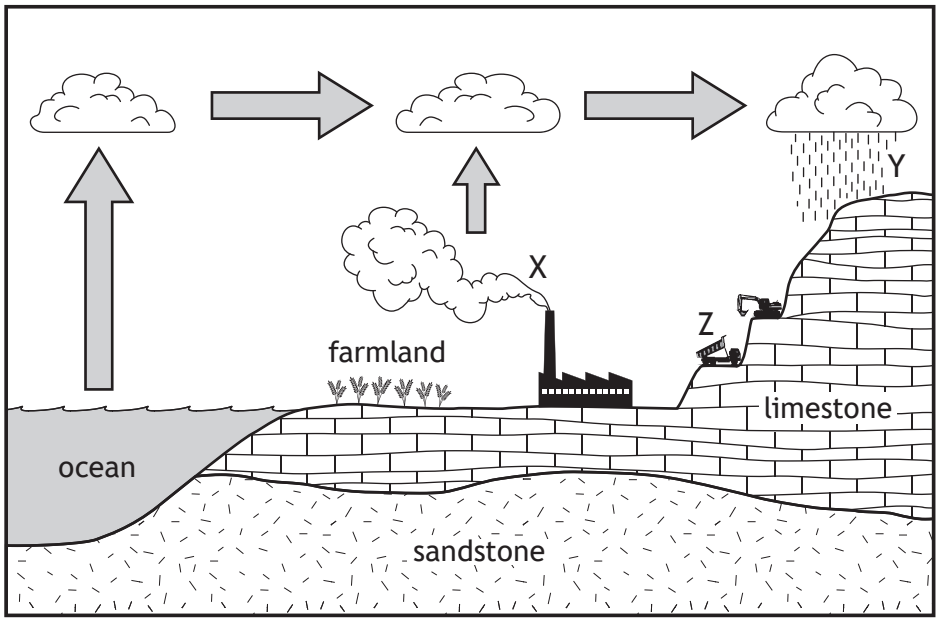
4. The geological carbon cycle is the interaction between the carbon cycle and the rock cycle. This results in the formation of sedimentary rocks, such as limestone.

(a) (i) Name the Earth system in which limestone is found. **1**

(ii) Describe the formation of limestone. **2**

(b) The diagram shows a landscape featuring exposed limestone.



(i) Carbon dioxide released from location X reacts with water in the atmosphere to form an acid.

(A) Name the acid formed. **1**

(B) Identify the type of weathering caused by the acid at location Y. **1**

4. (b) (continued)

(ii) Limestone is quarried at location Z.

Decide if each of the following statements about the impacts of limestone extraction and processing is True or False and tick (✓) the appropriate box.

If the statement is False, write the correct word(s) in the Correction box to replace the word underlined in the statement. **3**

Statement	True	False	Correction
Dust from the quarry may coat leaves of nearby plants, reducing <u>respiration</u>			
Processing limestone involves cutting and <u>smelting</u>			
Local waterways may become polluted as sediment is carried by <u>run-off</u> after a rainfall event			

(c) Once extracted, limestone can be used in the agricultural sector.

Describe one use of limestone in agriculture. **1**

(d) State why limestone is described as a carbon sink. **1**

[Turn over

5. Fast fashion is the production of large quantities of cheap clothing in response to the latest trends. The increase in popularity of fast fashion has resulted in a rise in global greenhouse gas emissions.

(a) (i) Other than carbon dioxide, name one greenhouse gas that may be released in the production and transport of clothing. **1**

(ii) Explain why these gases are referred to as greenhouse gases. **2**

5. (continued)

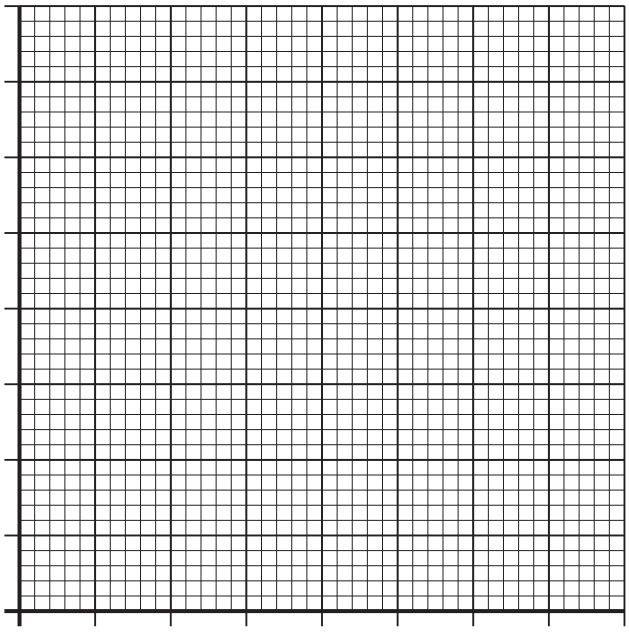
(b) Fast fashion has contributed to the growth of the fashion and textiles industry in recent years.

The total income generated by the fashion and textiles industry in the UK, from 2019 to 2023, is shown in the table.

Year	Total income (£ billion)
2019	42
2020	52
2021	55
2022	60
2023	62

Using the information from the table, draw a **line graph** to show the total income generated each year. **3**

(An additional graph, if required, can be found on *page 36*.)



[Turn over

5. (continued)

(c) Many fashion brands are limiting their use of plastic and exploring more sustainable materials. One possible option is linen, which is made from the stalks of flax.

An increase in demand for linen fabrics and clothes will require large quantities of flax crops.

(i) Explain how one named strategy could increase the yield of the flax crops. **3**

Strategy

Explanation

MARKS

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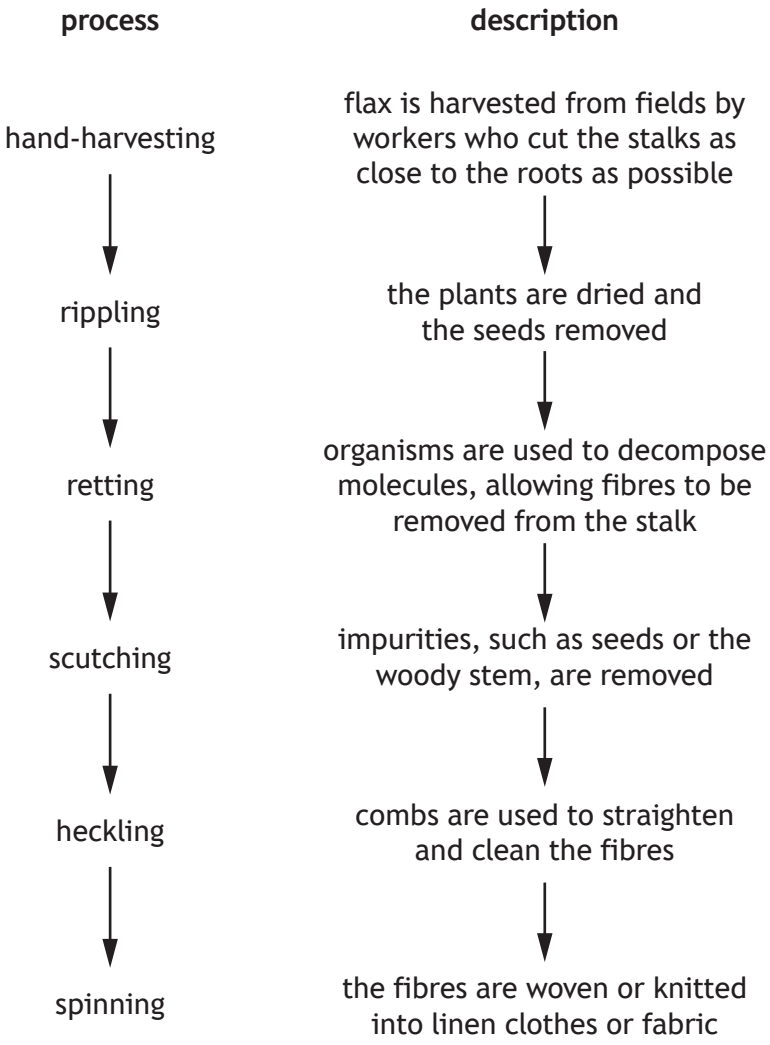
(ii) Some companies use traditional methods to produce linen from flax by hand. The processes involved are shown in the flow chart.



(A) Suggest an economic benefit of cutting the stalks as close to the roots as possible when hand-harvesting. **1**

(B) Suggest a type of organism that can be used in the retting process. **1**

[Turn over

5. (c) (ii) (continued)

(C) Describe why flax is classified as a renewable resource. **1**

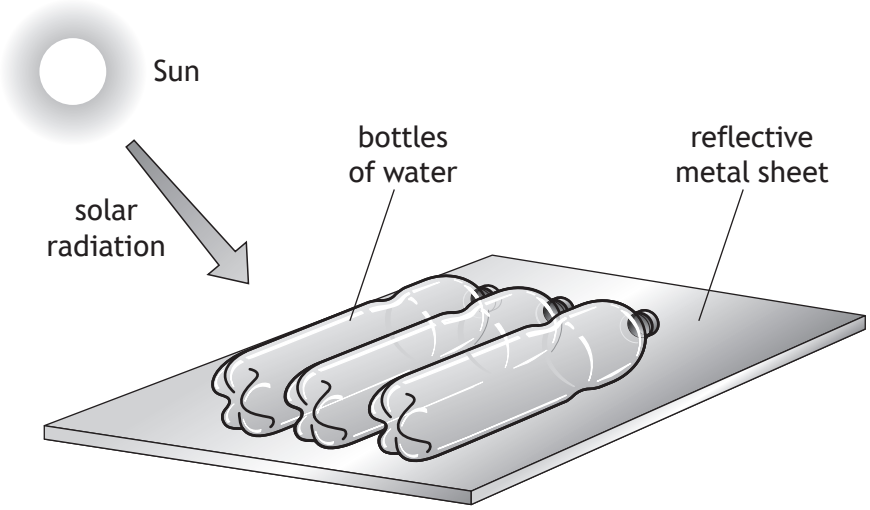
(D) Explain why the production and processing of linen by hand, using traditional methods, may be considered carbon neutral. **2**

(d) Other than flax, suggest one economically important species of plant or animal that can provide a named resource to make clothes. **1**

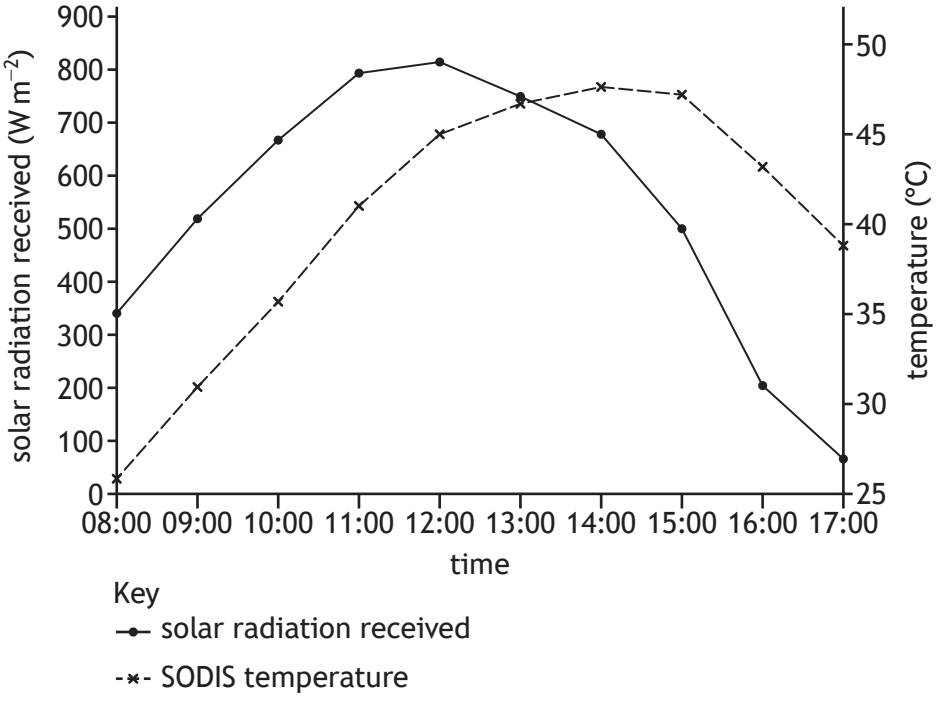
Species

Resource

6. Solar water disinfection (SODIS) is commonly used to make contaminated water safe enough to drink. It does this by using a combination of solar radiation and higher temperatures to kill bacteria.



(a) The graph shows the changes in solar radiation received and temperature throughout various times of the day.



SODIS is most effective when the solar radiation received is above 500 W m^{-2} and the temperature is above 45 °C.

Using the information provided, state the times between which SODIS is the most effective. **1**

[ ] to [ ]

6. (continued)

(b) A team of environmental scientists analysed the abundance of three different types of bacteria within a water sample. These were coliform, *E. coli*, and hydrogen-sulfide producing bacteria.

(i) Coliform bacteria can be used as an indicator species.

State what is meant by the term *indicator species*. **1**

(ii) The contaminated water was added to a bottle and placed on a reflective sheet of metal. The abundance of the bacteria was sampled after 2, 24, and 48 hours. The results are shown in the table.

	Percentage of micro-organisms surviving (%)		
Type of bacteria	**2 hours**	**24 hours**	**48 hours**
Coliform	99.3	49.3	0
E. coli	79.6	33.7	0
Hydrogen-sulfide producing	98.2	39.9	0

(A) Explain why the water must be left for 48 hours before use. **1**

(B) Explain how reducing the number of bacteria in drinking water can lead to economic development within a country. **2**

6. (b) (continued)

(iii) Name one other method that can be used to produce clean water in a developing country. **1**

(c) Suggest one difference that may exist in the processing and storing of water supplies between developed and developing countries. **1**

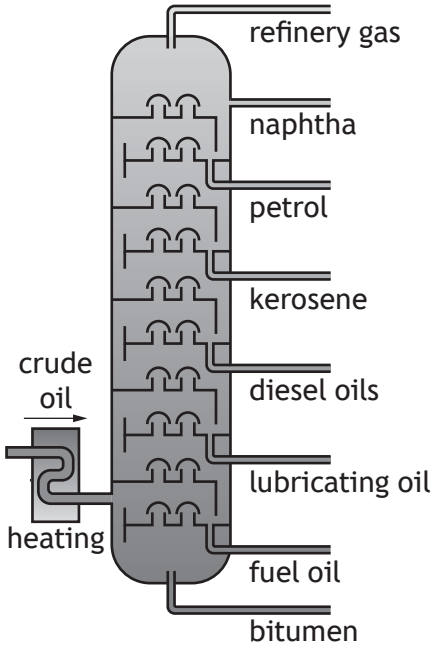
[Turn over

7. (a) Global sales of electric vehicles have increased rapidly in recent years.

The International Energy Agency has estimated that the current number of electric vehicles has reduced the extraction and processing of approximately 550 000 barrels of crude oil each day.

(i) State the method used to extract crude oil from beneath the Earth's crust. **1**

(ii) During processing, the crude oil is separated into useful products, known as fractions.



Using the information provided, identify the fraction with:

(A) the lowest boiling point **1**

(B) the greatest molecular size. **1**

7. (a) (continued)

(iii) Describe the role of temperature in the formation of the different fractions. **3**

(b) Suggest one positive social impact of switching from fossil-fuel powered vehicles to electric vehicles. **1**

[Turn over

SECTION 2 — 20 marks

Attempt ALL questions

8. *Sargassum* is a type of brown algae. It is found floating on the surface of oceans and obtains its energy through photosynthesis. Wind and ocean currents cause the *Sargassum* to form large rafts.

In the Atlantic Ocean, the *Sargassum* rafts have increased in size to form an 8000-km long belt. This belt is known as the Great Atlantic Sargassum Belt, which stretches from the west coast of Africa to the Gulf of Mexico.

Giant clumps of *Sargassum* are breaking off the belt and washing ashore on beaches and coastlines in the Caribbean and Gulf of Mexico, where they start to decompose. Countries affected by this are concerned about the social, economic, and environmental impacts of decomposing *Sargassum* on the beaches along the coastlines.

One of the countries affected is exploring ways to deal with this challenge and is considering two proposals.

The first proposal involves the collection of washed-up *Sargassum*. Salt, sand, microplastics, and heavy metals, such as toxic mercury, will be removed. The cleaned *Sargassum* will then be processed into biofuel and used as an alternative to traditional fuels.

The second proposal involves the use of solar-powered robots to collect any broken-off clumps of *Sargassum* before they reach beaches and coastlines. The robot will take the *Sargassum* back into the ocean and submerge it to a minimum depth of 135 m, where the *Sargassum* then sinks to the bottom of the ocean.

Using the information shown in the supplementary source booklet and your knowledge of environmental science, answer the following questions.

8. (continued)

(a) Air bladders present in *Sargassum* allow it to float on water. They contain gas that the *Sargassum* produces during photosynthesis.

(i) Name the gas found in the air bladders. **1**

(ii) Suggest one benefit to the *Sargassum* of floating on the surface of the ocean. **1**

(b) The Amazon River carries nutrients from several South American countries into the Atlantic Ocean. These nutrients cause the Great Atlantic Sargassum Belt to grow quickly in mass.

(i) Suggest one reason why the Amazon River is nutrient rich. **1**

(ii) One of the areas experiencing the greatest build-up of *Sargassum* is the Gulf of Mexico.

Suggest why large quantities of *Sargassum* are found in this area. **2**

[Turn over

8. (continued)

(c) The South Atlantic Fishery Management Council has banned the removal of *Sargassum* from the Great Atlantic Sargassum Belt. This was due to the habitat it provides for a variety of organisms.

(i) Explain the impact that the removal of such habitats would have on biodiversity. **2**

(ii) Suggest one conflict that may arise between another named stakeholder and the South Atlantic Fishery Management Council. **1**

8. (continued)

(d) One proposal suggests processing the *Sargassum* into biofuel.

Under the proposal, the government would pay for the collection and transportation of the *Sargassum* to biofuel production plants. These production plants would be built, and paid for, by a private company. The company would receive 80% of profits from the sale of the biofuel.

(i) State what is meant by the term *biofuel*. **1**

(ii) The *Sargassum* would be processed into biofuel using fermentation.

Describe the process of fermentation. **2**

[Turn over

8. (continued)

(e) The second proposal suggests the use of solar-powered robots to collect *Sargassum* floating on the surface of the ocean. Solar energy would be stored in batteries inside the robot.

The process, shown in **Source 4**, involves the robots taking the *Sargassum* down to a minimum depth of 135 m. The pressure at 135 m affects the *Sargassum*'s air bladders, causing the *Sargassum* to sink to the ocean floor.

(i) Suggest how the air bladders are affected when the *Sargassum* reaches a depth of 135 m. **1**

(ii) The average density of seawater in the Atlantic Ocean is 1024 kg m^{-3}.

The pressure due to the seawater can be calculated using the formula

$$p = \rho g h$$

where: p is the pressure in pascals (Pa)

ρ is the density of the seawater in kg m^{-3}

g is the gravitational field strength = 9.8 N kg^{-1}

h is the depth in metres (m).

Calculate the pressure at a depth of 135 m. **1**

Space for calculation

Pa

8. (e) (continued)

(iii) It is estimated that 6 tonnes of *Sargassum* can absorb 1.2 tonnes of carbon dioxide. This carbon dioxide is then trapped in the *Sargassum* deposited on the ocean floor.

The robot collects 16 tonnes of *Sargassum* before each dive.

Calculate the mass of carbon dioxide that could be trapped with each dive. **1**

Space for calculation

(iv) The mass of *Sargassum* available for collection by the robots would be greatest in the summer months.

Suggest why there is a greater mass of *Sargassum* available for collection by the robots in the summer. **2**

[Turn over

8. (continued)

(f) Using the evidence from the sources and your knowledge of environmental science, decide which proposal should be adopted.

Indicate your choice by ticking (✓) **one** of the boxes.

Justify your decision. **4**

☐ Process into biofuel

☐ Sink using solar-powered robots

SECTION 3 — 14 marks

Questions 9 and 10 each contain a choice

Write your answers to questions 9 and 10 on the following pages.

You may use diagrams where appropriate.

9. A Invasive non-native species (INNS) can have a major impact on the United Kingdom's (UK) ecosystems. Their distribution and impact are often closely monitored by relevant national organisations.

Describe:

(a) the impact of **one** named INNS in the UK

(b) the role of **one** relevant national organisation involved in monitoring INNS. **7**

OR

B Human activities can have either a negative impact on biodiversity, such as the introduction of invasive non-native species (INNS), or a positive impact.

Explain how **other** named human activities can result in a:

(a) negative impact on biodiversity

(b) positive impact on biodiversity. **7**

10. A A key process of the hydrosphere is the movement of water around, over, and through the Earth. This is called the water cycle.

Discuss the processes of the water cycle. **7**

OR

B Water is essential for many different sectors throughout the world.

Discuss the uses of water in the industrial, domestic, and agricultural sectors. **7**

[Turn over

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SPACE FOR ANSWERS

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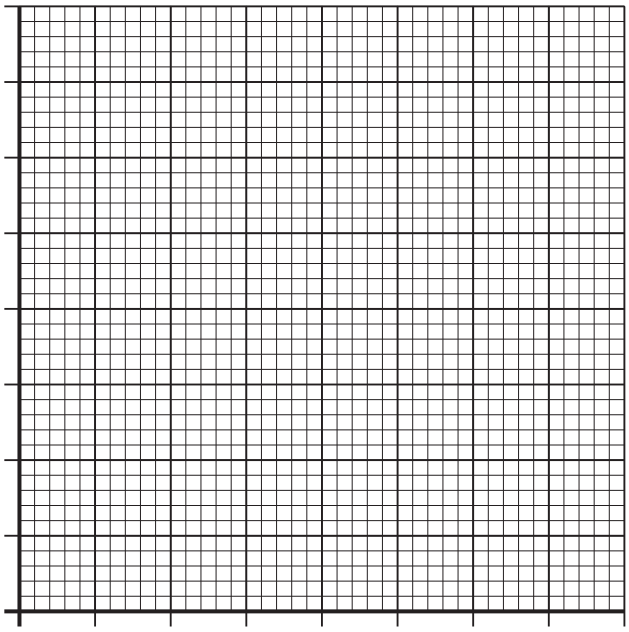
[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

Additional graph for question 5 (b)



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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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