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ENVIRONMENTAL MANAGEMENT

8291/23

Paper 2 Management in Context

October/November 2024

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **24** pages. Any blank pages are indicated.



1 Carbon capture and storage are strategies for managing climate change.

Some companies are developing strategies to use captured carbon instead of storing the captured carbon.

- (a) Suggest the disadvantages of storing captured carbon rather than using captured carbon.

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..... [3]

- (b) In 2018, a company developed a unit for using carbon dioxide emitted from industry. The units are called 'CO₂ntainers'.

Industrial waste products are reacted in a CO₂ntainer with captured carbon dioxide at the location where the carbon dioxide is emitted.

- (i) Each CO₂ntainer can treat a maximum of 12 000 tonnes of industrial waste per year.

Four CO₂ntainers are used at a factory.

Calculate the maximum mass of industrial waste the four CO₂ntainers can treat in five years.

mass = tonnes [2]





(ii) Calcium carbonate and magnesium carbonate are produced by the CO₂ntainers.

Fig. 1.1 shows calcium carbonate and magnesium carbonate which are used in the construction industry.



Fig. 1.1

Suggest how the CO₂ntainer process reduces negative impacts on the environment.

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..... [4]





(iii) The CO₂ntainers use a process called carbonation. This process also occurs naturally.

Organisms with shells absorb carbon dioxide from sea water and produce calcium carbonate for their shells.

Suggest how this carbon dioxide is naturally stored for millions of years.

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..... [3]

(c) Carbon dioxide is a limiting factor in the process of photosynthesis.

State **two** other limiting factors in the process of photosynthesis.

1

2 [2]

[Total: 14]

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- 2 (a) 'Climate TRACE' is a global organisation that collects and shares data on greenhouse gas emissions from human activities.
- (i) Table 2.1 shows data from Climate TRACE for carbon dioxide emissions from six different sectors.

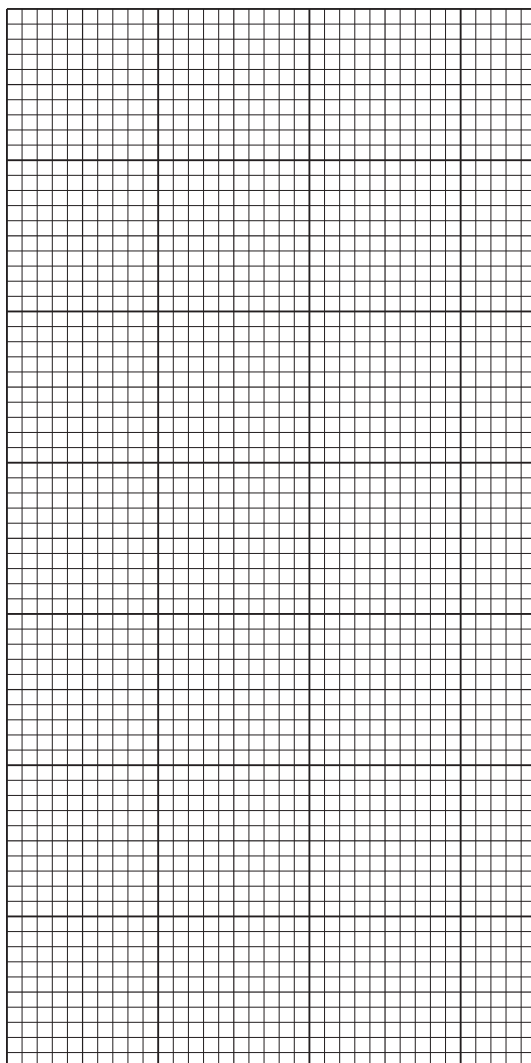
Table 2.1

sector	carbon dioxide emissions /billion tonnes
power	13
manufacturing	10
transport	7
agriculture	6
oil and gas production	5
waste disposal	3





Plot the data as a bar chart on the grid.



[4]

- (ii) Climate TRACE uses data from more than 300 satellites and measurements from 11 000 sensors to estimate greenhouse gas emissions.

Climate TRACE uses artificial intelligence to build computer models for sectors with less access to data.

Suggest how Climate TRACE can positively impact the reporting of climate change.

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[3]





(b) Fig. 2.1 shows Climate TRACE data for the transport sector from 2015 to 2020.

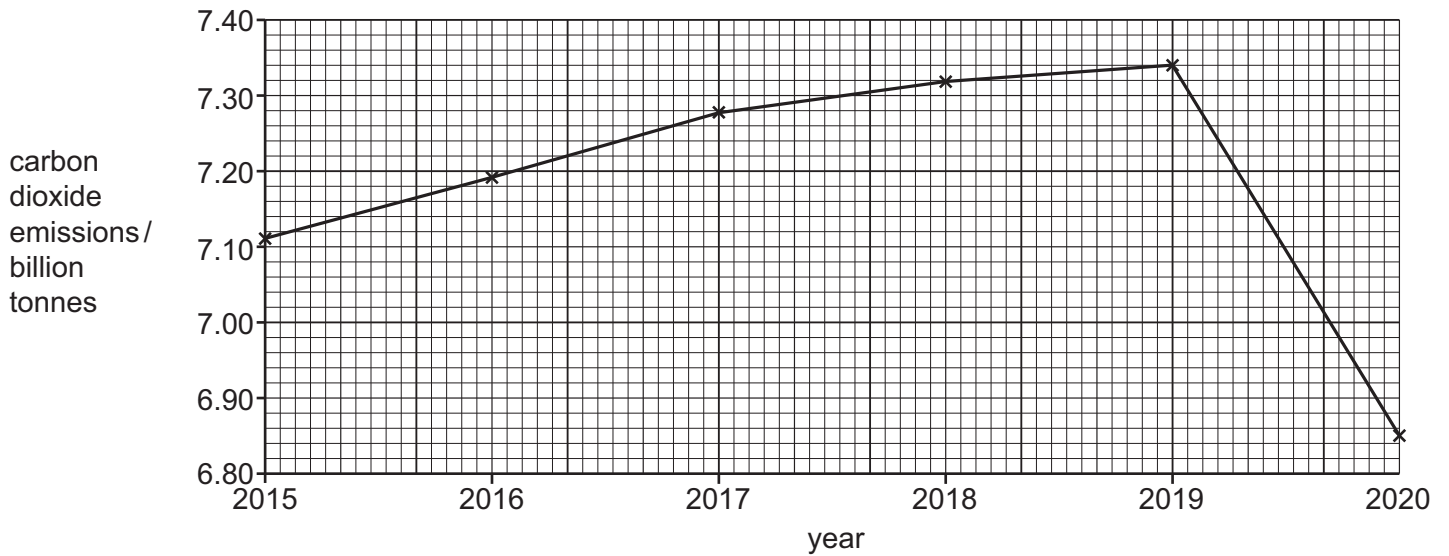


Fig. 2.1

- (i) Calculate the percentage change in carbon dioxide emissions for the transport sector from 2015 to 2020.

Give your answer to **three** significant figures.

.....% [3]

- (ii) Suggest reasons for the change in carbon dioxide emissions for the transport sector shown in Fig. 2.1 from 2019 to 2020.

.....

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.....

..... [2]

- (c) Waste disposal contributes 6% of global greenhouse gas emissions.

State **four** methods of waste disposal on land.

- 1
- 2
- 3
- 4

[4]





(d) Waste from farmed chickens can be used to generate energy.

Chicken litter is a mixture of wood shavings, straw and chicken manure.

Straw is the dried parts of cereal plants. Farmed chickens eat a plant-based diet.

The chicken litter is combusted in a furnace and the heat is used to convert water in pipes to steam. The steam is used to turn a turbine and a generator.

(i) Explain why combusting chicken litter does **not** increase the overall net concentration of carbon dioxide in the atmosphere.

.....

.....

.....

..... [2]

(ii) Chicken litter is a renewable fuel.

Name this type of renewable fuel.

..... [1]

(iii) Fast-growing trees such as eucalyptus are used instead of chicken litter to generate electricity.

Suggest the negative impacts of growing eucalyptus trees.

.....

.....

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..... [2]

[Total: 21]





3 (a) A farmer investigates insect pests on soybean plants.

Fig. 3.1 shows soybean plants.



Fig. 3.1

The farmer investigates an area of soybean plants that is 7 rows by 7 columns. There is a total of 49 soybean plants.

Fig. 3.2 shows the results from a random number generator.

The farmer uses these results to select a sample of 6 soybean plants. Each number represents a row number and a column number.

56	71	29	56	33	22	32	60	53	28	23	72	13
----	----	----	----	----	----	----	----	----	----	----	----	----

Fig. 3.2

The farmer starts at number '56'.

'56' represents row 5 and column 6. The farmer circles this plant on Fig. 3.3.

The farmer ignores a number in Fig. 3.2 if:

- any part of the number is greater than 6
- a number is repeated.



Fig. 3.3 shows the area of soybean plants the farmer investigates.

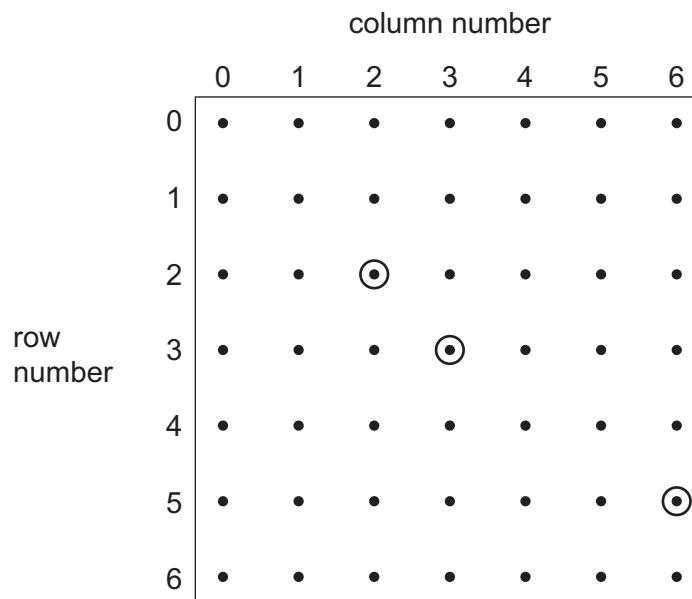


Fig. 3.3

- (i) The farmer samples a total of 6 plants.

The first 3 soybean plants selected from the random number generator are circled.

Complete Fig. 3.3 by circling the **3** other soybean plants the farmer samples. [1]

- (ii) State **one** benefit of using a random number generator to select the soybean plants.

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..... [1]



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(c) The farmer concludes that the soybean plants are infested with aphids.

Aphids are insects that eat soybean plants and reduce crop yield.

The farmer introduces the harlequin beetle to the soybean plants. The harlequin beetle is a flying insect and is a predator of the aphids.

Fig. 3.4 shows a harlequin beetle.

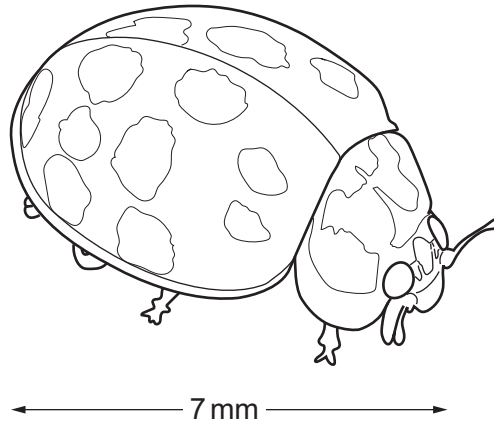


Fig. 3.4

The farmer records the population of aphids in 2 different fields.

Fig. 3.5 shows the results.

Key

- * — field 1: no predator
- * - field 2: predator added

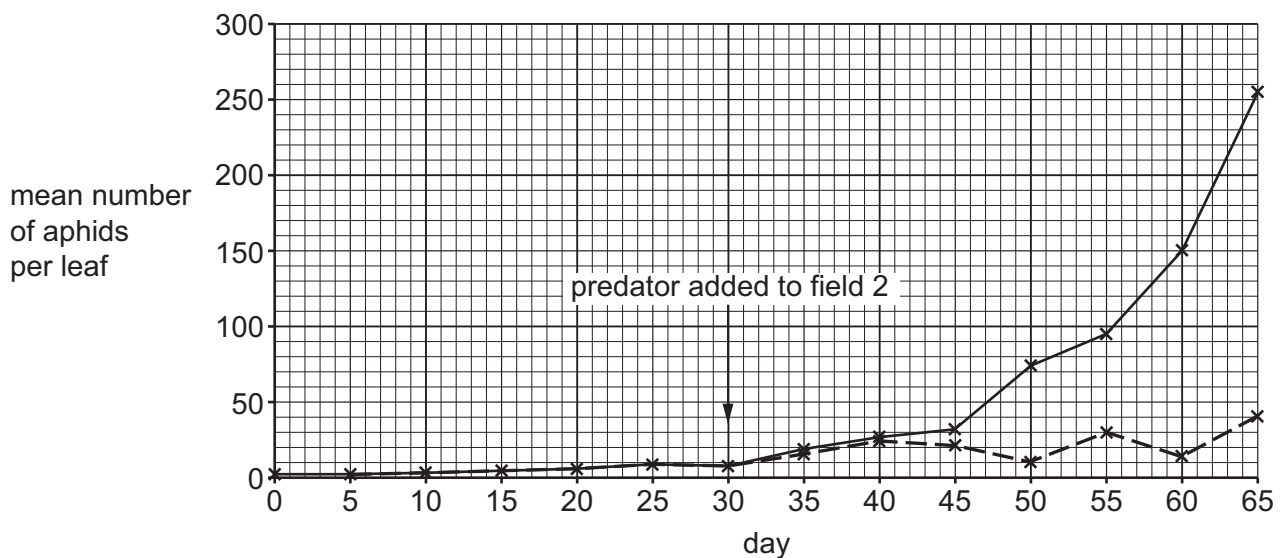


Fig. 3.5





(i) Name the type of method for controlling the aphid population using a predator.

..... [1]

(ii) Suggest why the predator was **not** added to field 1.

..... [1]

(iii) Suggest why the aphid population was measured before the predator was added to field 2.

.....

..... [1]

(iv) Write a conclusion using the data in Fig. 3.5.

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..... [3]

(v) Suggest why the farmer covers the soybean plants with nets after the predator is added.

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..... [2]

(d) The harlequin beetle was introduced to North America and Europe to control aphid populations. The harlequin beetle is now considered to be one of the world's most invasive species.

The harlequin beetle becomes inactive when temperatures are lower than 10°C.

Suggest why climate change could benefit the harlequin beetle.

.....

..... [1]





(e) Increasing crop productivity by reducing pests is a strategy for managing food security.

Hydroponics can also improve food security.

(i) Explain how hydroponics improves food security.

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..... [4]

(ii) Describe the limitations of large-scale food stockpiling as a method of reducing food insecurity.

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..... [3]

(iii) Outline the impacts of food insecurity.

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..... [4]

[Total: 29]



4 (a) Fig. 4.1 shows the distribution of hot desert biomes.

Key

■ hot desert biome

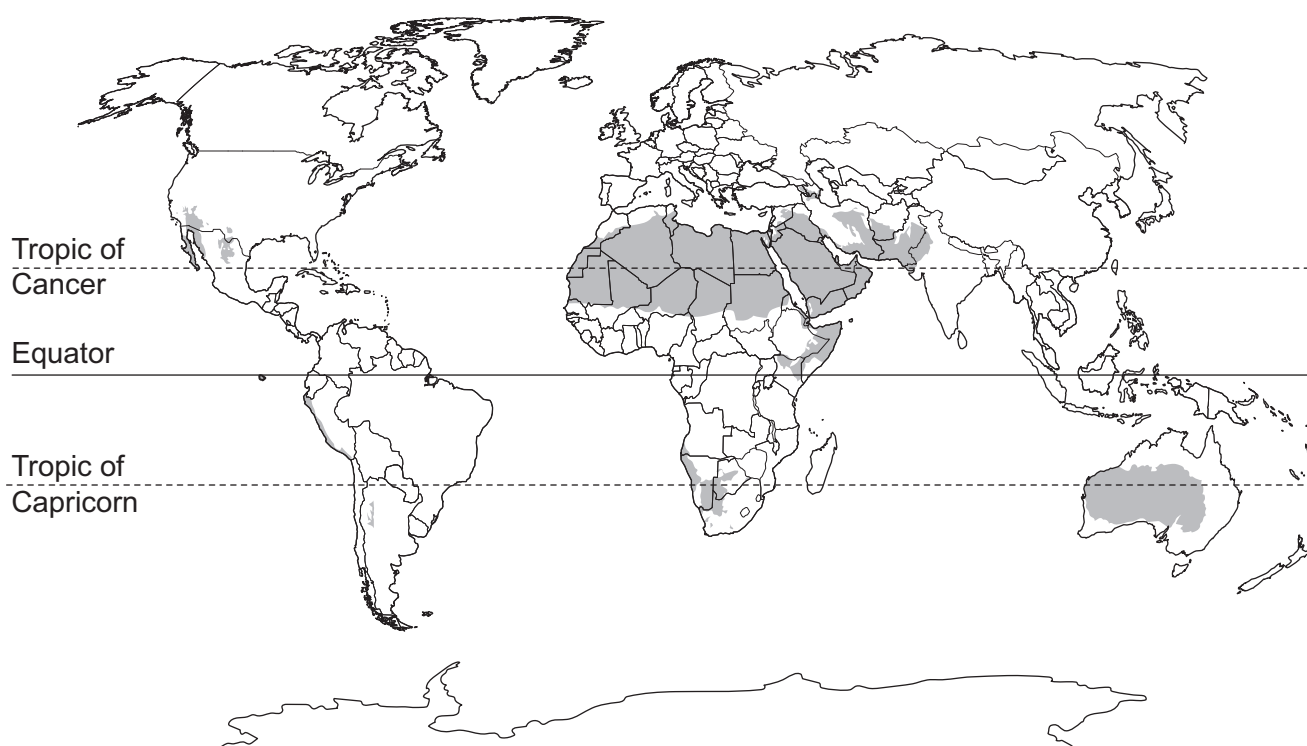


Fig. 4.1

(i) Describe the distribution of hot desert biomes.

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.....

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..... [3]

(ii) Draw an **X** on the map in Fig. 4.1 to indicate the location of a cold desert. [1]





(b) Fig. 4.2 shows climate data for a hot desert biome.

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Fig. 4.2

- (i) Complete Fig. 4.2 by drawing a line between data points for the temperature data. [1]
- (ii) Calculate the range for precipitation in the desert biome in Fig. 4.2.

.....mm [1]





(iii) A desert biome receives 300 mm of precipitation a year.

A rainforest biome receives 2000 mm of precipitation a year.

Calculate the simplest whole number ratio for precipitation in the desert biome compared to the rainforest biome.

..... : [1]

(iv) Circle **all** the types of vegetation associated with a hot desert biome.

cactus grass lichen moss vine [1]





(c) Table 4.1 shows categories for percentage cover on the ACFOR scale.

Table 4.1

percentage cover	ACFOR scale
90–100	A
50–89	C
20–49	F
5–19	O
<5	R
0	X

(i) Complete Table 4.2 by naming the categories on the ACFOR scale.

Table 4.2

ACFOR scale	name
A	abundant
C	common
F	
O	
R	

[1]





- (ii) A scientist investigates plant species on the edge of a desert biome.

Table 4.3 shows the results.

Complete Table 4.3 by determining the ACFOR scale for each plant species.
Use the letters A, C, F, O, R or X.

Table 4.3

plant species	percentage cover	ACFOR scale
U	82	
V	4	
W	32	
Y	51	
Z	49	

[2]

- (iii) State **two** limitations of the ACFOR scale.

1

.....

2

.....

[2]





- (d) The scientist compares the current number of bird species with historic data from locations within a hot desert biome.

Fig. 4.3 shows the results.

Each plot represents a different location in the biome.

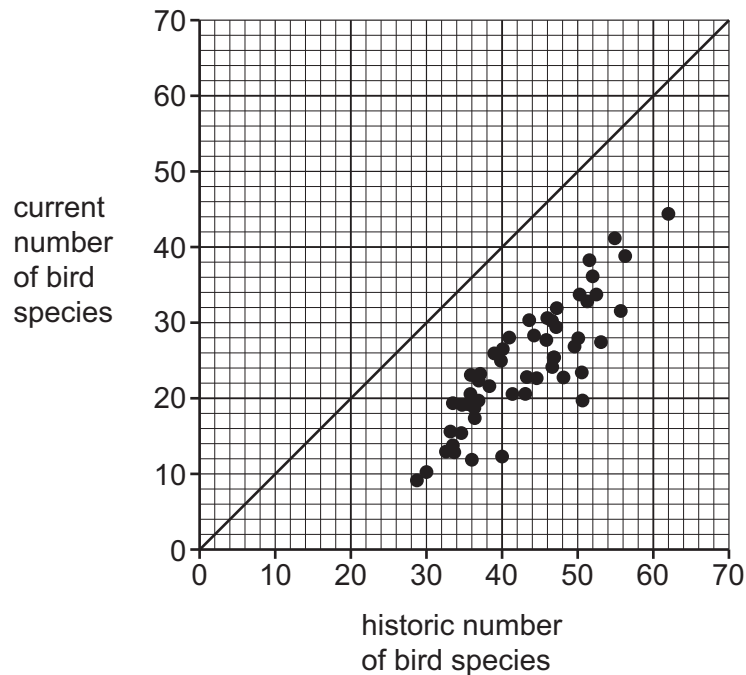


Fig. 4.3

- (i) Plot the data in Table 4.4 on the grid in Fig. 4.3.

Table 4.4

number of bird species	
historic	current
25	9

[1]

- (ii) Describe what the results in Fig. 4.3 show.

..... [1]

- (iii) The scientist found that the probability of a bird species colonising a new location within the desert biome was 0.003.

Describe the meaning of this data.

..... [1]

[Total: 16]





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