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ENVIRONMENTAL MANAGEMENT **0680/23**

Paper 2 Management in Context **October/November 2021**

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 **32** pages. Any blank pages are indicated.

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[Turn over

world map showing the location of Costa Rica



map of Costa Rica

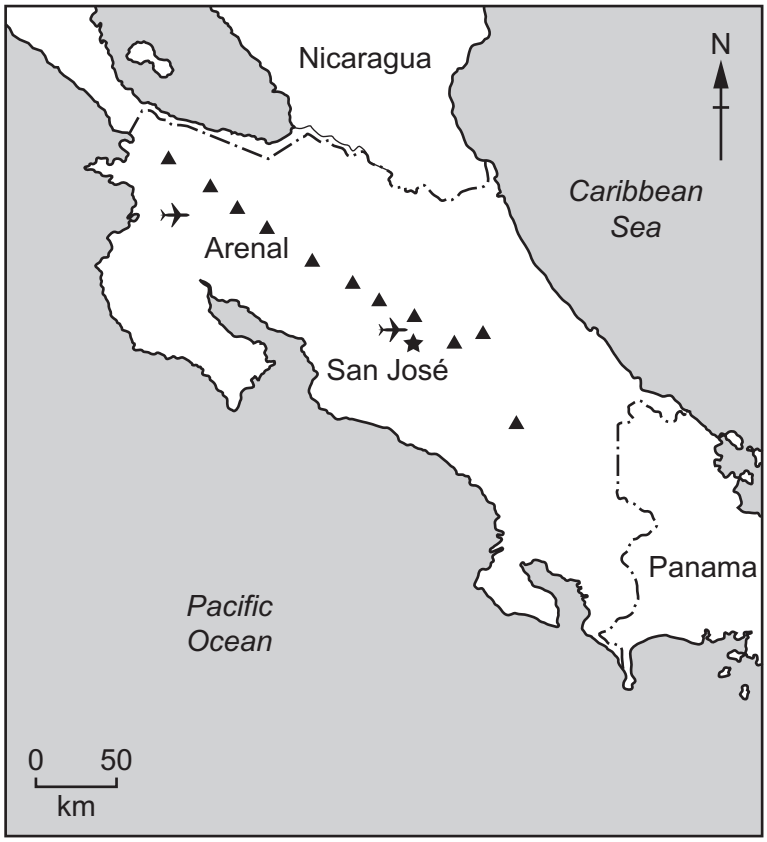
Key

★ capital city

✈ airport

▲ volcano

–·–·– international boundary



Area of Costa Rica: 51 100 km^2

Population of Costa Rica: 4.99 million (in 2019)

Children per woman: 1.89 (in 2019)

Life expectancy: 78.9 years

Currency: Costa Rican colón (610 CRC = 1 USD in 2019)

Language: Spanish and English

Climate of Costa Rica: tropical with a dry season and wet season; cooler in highlands

Terrain of Costa Rica: coastal lowlands separated by central mountains, including several active volcanoes, large areas of forest and rainforest

Main economic activities of Costa Rica: ecotourism and agricultural production including bananas, coffee, sugar and beef

Costa Rica's rich biodiversity attracts many ecotourists. The government has invested in education, healthcare, electricity, clean water and sanitation. Life expectancy has increased over the last 60 years. In 2019, 21.7% of the population lived in poverty. Urban areas had 78% of the population. The population of the capital city, San José, was 339 581.

1 (a) (i) A survey found that 24 362 people did not have access to electricity in Costa Rica in 2019.

Calculate the percentage of the population of Costa Rica without access to electricity in 2019.

..... % [1]

(ii) Suggest **one** difficulty for people living without access to electricity.

.....

..... [1]

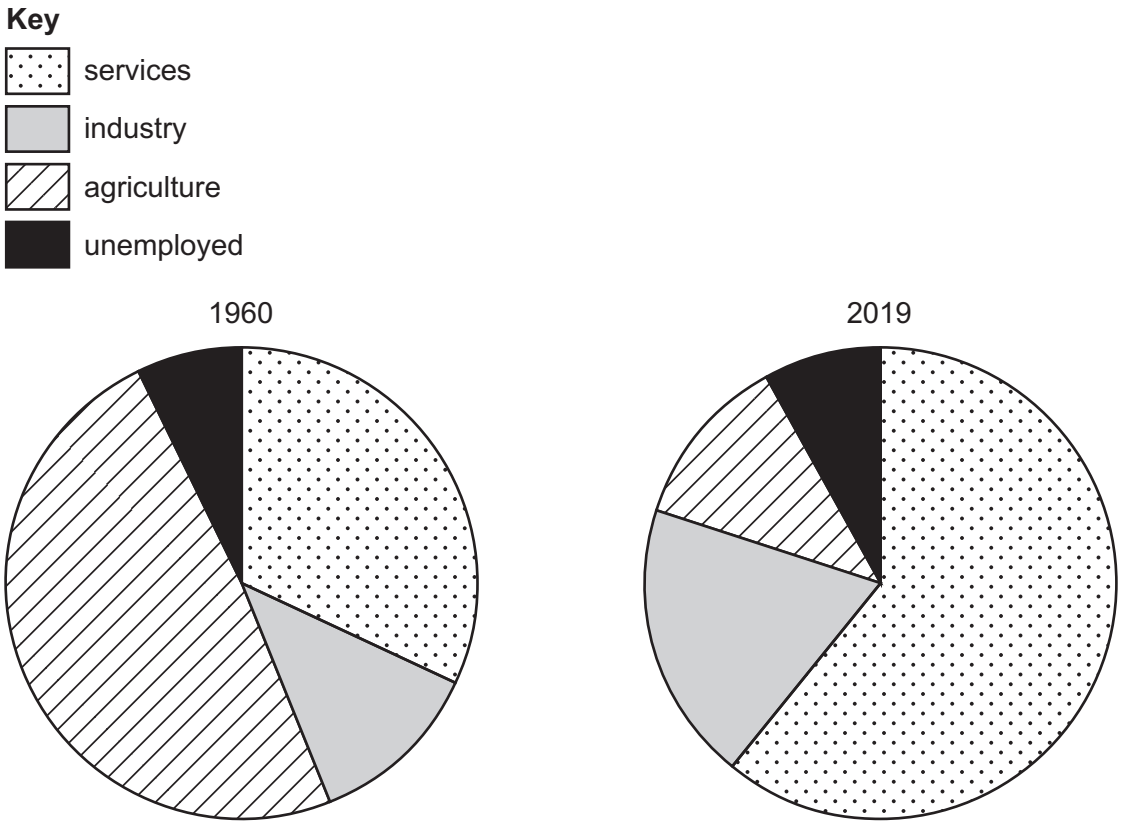
(iii) Suggest why improvements in sanitation have increased life expectancy in Costa Rica.

.....

..... [1]

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(b) The pie charts show the percentage of people employed in services, industry and agriculture and the percentage of people unemployed in Costa Rica in 1960 and in 2019.



Suggest reasons for the difference in the percentage of people employed in services in 1960 and in 2019.

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..... [3]

(c) The maps show how the area of forested land in Costa Rica has changed between 1940 and 2010.

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(i) Describe the trends in how the area of forested land in Costa Rica has changed between 1940 and 2010.

.....

.....

.....

..... [2]

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(ii) State **three** impacts of deforestation.

1 .....

2 .....

3 .....

[3]

(iii) Many people around the world are concerned about deforestation.

Suggest reasons why deforestation is a **global** concern.

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..... [2]

(d) Climate data was recorded at a weather station in Costa Rica for one year.

(i) The table shows rainfall data from the weather station.

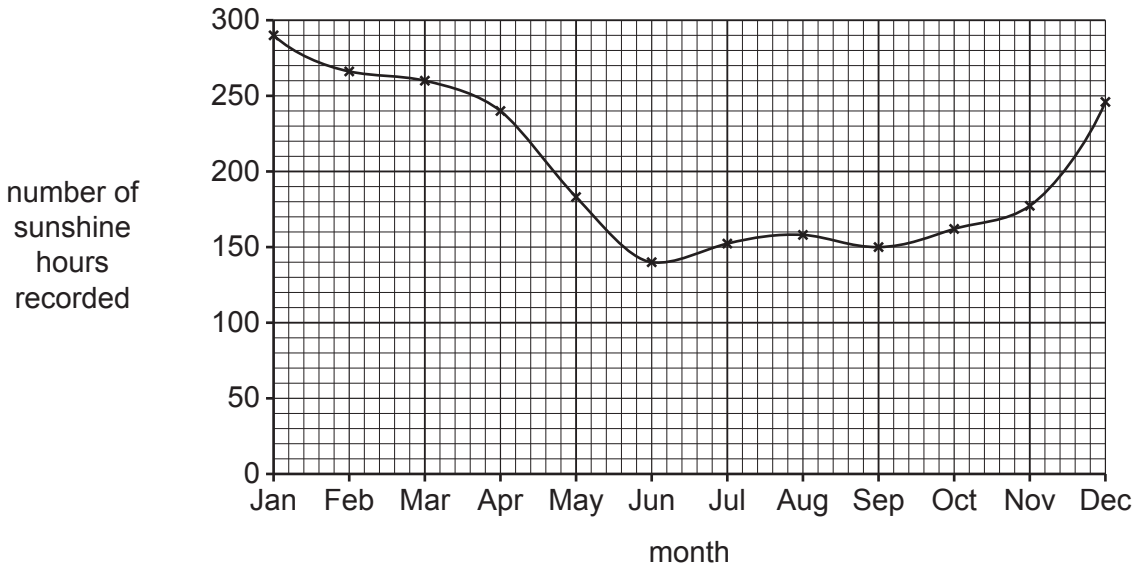
month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
rainfall / mm	150	95	85	140	320	310	310	330	330	400	320	150

The wet season in Costa Rica is the seven months from May to November.

Calculate the average rainfall per month during the wet season.

..... mm [1]

(ii) The graph shows the number of sunshine hours recorded at the weather station each month.



The annual range of monthly sunshine hours is the difference between the maximum and the minimum number of sunshine hours recorded in a month.

Calculate the annual range of monthly sunshine hours shown in the graph.

..... hours [2]

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(e) Bananas and coffee are two cash crops grown in Costa Rica.

(i) Banana plants and coffee plants use photosynthesis to produce glucose and oxygen from carbon dioxide and water.

Explain the importance of chlorophyll in photosynthesis.

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..... [2]

(ii) State what is meant by a *cash crop*.

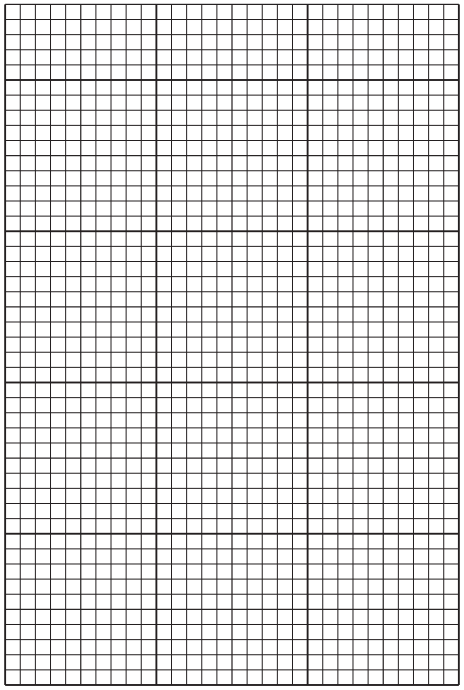
.....

..... [1]

(f) The table shows data for the percentage of electricity generated by different energy resources in Costa Rica.

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(i) On the grid, plot a bar chart of percentage of electricity generated for the five energy resources.



[4]

(ii) Calculate the total percentage of electricity in Costa Rica generated by renewable energy resources.

..... % [1]

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(iii) Explain how non-renewable energy resources contribute to climate change.

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..... [2]

(g) The photograph shows equipment used to generate electricity using wind power.



(i) Describe how wind power is used to generate electricity.

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.....

..... [2]

(ii) Suggest reasons why some people do **not** want this type of equipment built in rural areas.

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..... [2]

(iii) Suggest reasons why wind power **cannot** be used to generate large amounts of electricity in some countries.

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..... [2]

[Total: 32]

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2 **(a)** The fact sheet shows information on the Resplendent Quetzal bird.

The Resplendent Quetzal



The Resplendent Quetzal is a species of bird found in the forests of Costa Rica. Many tourists visit the forests to see the birds.

Resplendent Quetzal birds build their nests in dead trees by pecking holes in tree trunks. Their beaks are not strong enough to break into living trees.

The main predator of Resplendent Quetzal birds is the long-tailed weasel. The weasel climbs the rough bark of trees to eat the eggs and chicks in the nest.

The population of Resplendent Quetzal birds is decreasing.

One way of helping to increase the population of Resplendent Quetzal birds is to provide artificial nests, which are attached to smooth poles in the forest.



(i) Suggest ways the artificial nests help to increase the population of Resplendent Quetzal birds.

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..... [3]

(ii) Some forest areas in Costa Rica are ecological reserves.

Explain ways that ecological reserves protect endangered species.

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..... [3]

(b) A forest food chain is shown.

avocado tree → ground anole lizard → Resplendent Quetzal bird → long-tailed weasel

(i) State the name of the producer in this food chain.

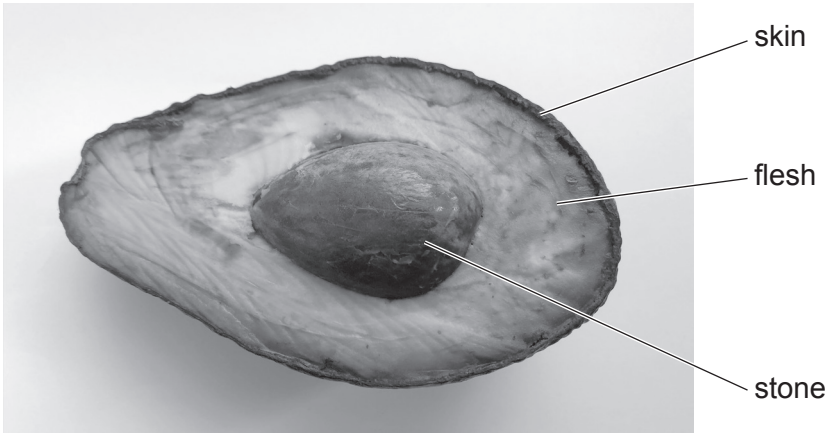
..... [1]

(ii) State the name of the tertiary consumer in this food chain.

..... [1]

(c) Avocados are a valuable crop.

The photograph shows an avocado fruit cut in half. Only the flesh of the fruit is edible.



A farmer wants to find out which fertiliser produces avocados with the greatest mass of flesh.

The farmer uses a balance to measure the mass of flesh of the avocado.

(i) Describe what the farmer must do to measure **only** the mass of the flesh.

.....

..... [1]

(ii) The farmer investigates the effect of four different fertilisers on avocado trees.

The farmer:

- selects five trees, **A** to **E**
- does **not** give fertiliser to tree **A**
- gives trees **B**, **C**, **D** and **E** a different fertiliser each
- records in a table the mass of avocado flesh for five fruits from each tree.

Complete the table by calculating the average mass of avocado flesh for tree **E**. Give your answer to a whole number.

	mass of avocado flesh / g					
tree	**fruit 1**	**fruit 2**	**fruit 3**	**fruit 4**	**fruit 5**	**average**
A	143	145	142	132	141	141
B	156	152	(29)	154	150	153
C	165	166	164	167	166	166
D	145	153	131	142	134	141
E	153	150	147	152	156	.....

[1]

(iii) Suggest why the farmer does **not** include the circled result for tree **B** fruit **3** in the calculation of the average mass of flesh.

..... [1]

(iv) Identify which tree, **B**, **C**, **D** or **E**, has the most effective fertiliser.

Give a reason for your answer.

tree .....

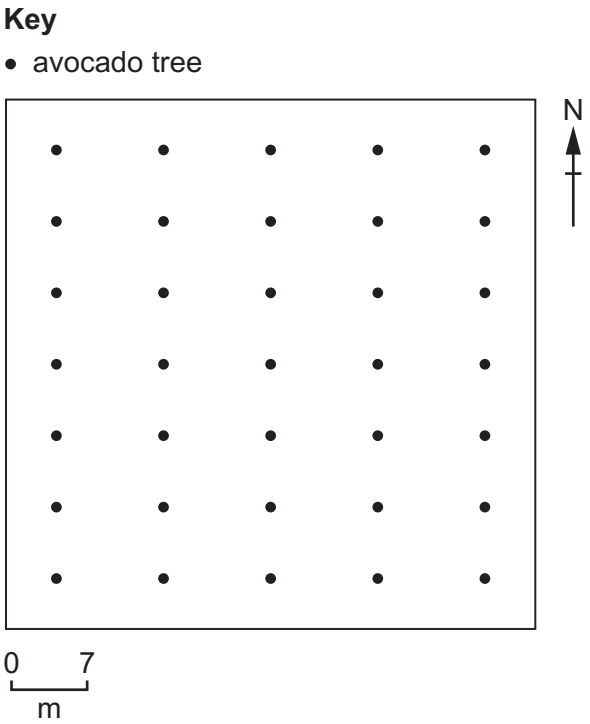
reason .....

.....

[1]

(v) The farmer wants to test the most effective fertiliser on a field of avocado trees.

The diagram shows the avocado trees in the field.



The farmer wants to select 10 of the trees in this field to sample.

The farmer wants to make sure that the sample of trees is unbiased.

Describe **one** sampling method the farmer can use to select the 10 trees from the field.

.....

.....

.....

..... [2]

(vi) Fertilisers can kill aquatic life if the nutrients they contain run off into water sources.

The nutrients increase the growth of algae. Eventually, the algae die.

Explain how the death of algae leads to the death of other aquatic life.

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..... [2]

(d) Avocado trees are pollinated by bees.

Explain why pollination is needed.

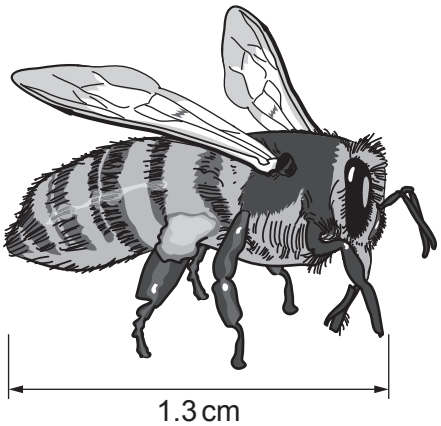
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..... [2]

(e) There are more than 650 species of bee in Costa Rica.



The farmer considers two different methods for surveying the bee population in the field of avocado trees.

method 1:

- select one avocado tree
- use a hand net to collect the bees that visit the tree during a 1-hour period
- count the bees and release them back into the wild.

method 2:

- select a 10 m × 10 m area of the field
- count all the bees seen during a 5-hour period
- repeat every day for a month.

(i) Suggest reasons why method 2 is better than method 1.

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..... [3]

(ii) Some data from a bee population survey are shown in the table.

Key

| 1 bee

𝍸 5 bees

sample	number of bees
1	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||||
2	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |
3	
4	
5	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||||
6	𝍸 𝍸 𝍸 𝍸 |

Use the key to complete the table to show:

- 2 bees in sample 3
- 33 bees in sample 4. [2]

(iii) Global bee populations are decreasing.

Scientists think that one reason for this decrease is the use of insecticides.

Suggest **two** other reasons why bee populations are decreasing.

1 .....

.....

2 .....

.....

[2]

(iv) Fertilisers and insecticides are used to increase agricultural yields.

State **two** other techniques used to increase agricultural yields.

1 .....

2 .....

[2]

[Total: 27]

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3 **(a)** The diagram shows the plate boundaries near Costa Rica. The arrows show the direction of plate movement.

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(i) Circle the type of plate boundary shown in the diagram.

conservative **constructive** **destructive** [1]

(ii) Describe what happens at the type of plate boundary shown in the diagram.

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..... [3]

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(b) The photograph shows the Arenal Volcano in Costa Rica.



Describe the benefits of living near to a volcano.

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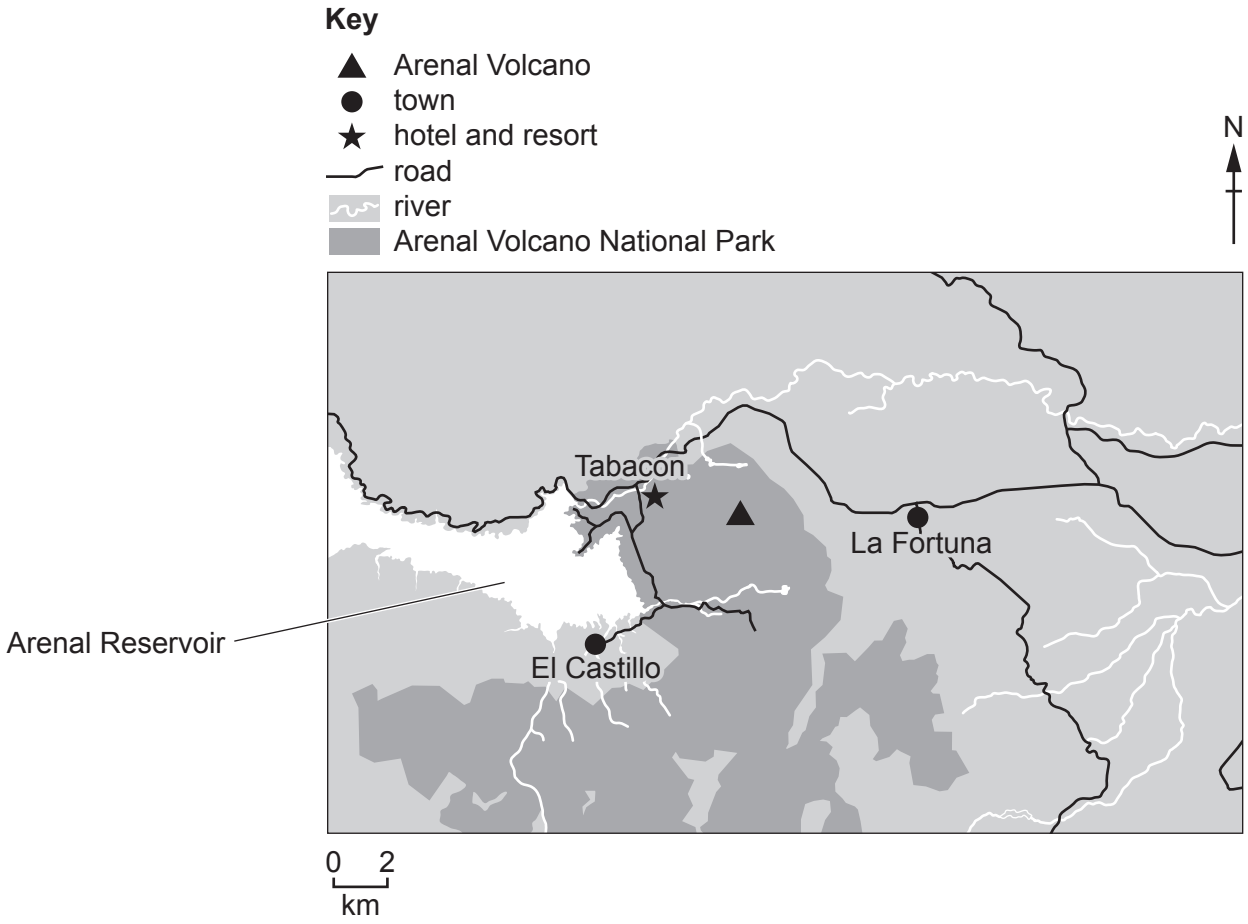
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..... [3]

(c) The Arenal Volcano erupted in 1968:

- More than 80 people were killed.
- Rocks were thrown at a speed of 60 m / s for over 1 km.
- Over 15 km^2 of land to the west of the volcano was completely buried with rocks and lava.
- An area of 232 km^2 was covered by volcanic ash.

The map shows the Arenal Volcano region in 2019.



(i) Loss of life was one impact of the 1968 Arenal Volcano eruption.

Use the map and information to suggest **other** impacts on the region if the Arenal Volcano erupts again.

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..... [4]

(ii) Describe strategies for managing the impacts of a volcanic eruption before the eruption occurs and during and after the eruption.

before the eruption occurs .....

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.....

.....

during and after the eruption .....

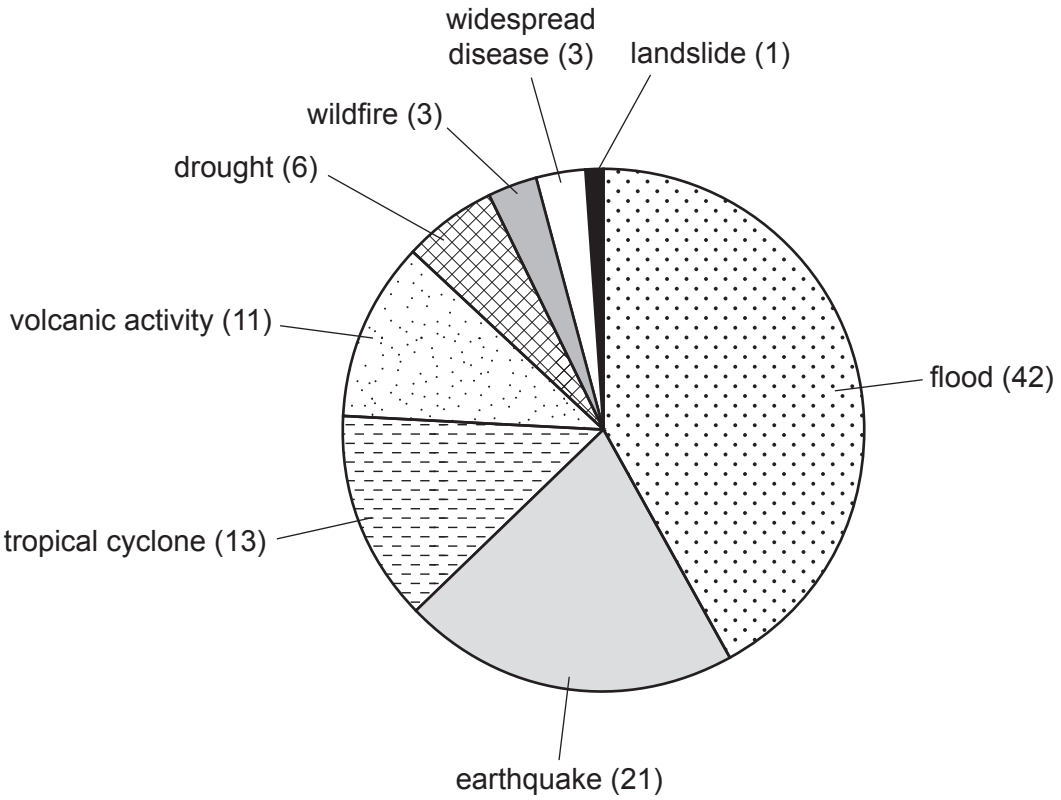
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[4]

(d) The pie chart shows the number of natural hazard events that have occurred in Costa Rica over a 100-year period.



(i) State whether it is sensible to invest a lot of money in strategies for managing the impacts of a volcanic eruption in Costa Rica.

Give reasons for your answer.

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..... [2]

(ii) Suggest reasons why climate change may increase the number of wildfires.

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..... [2]

(iii) Describe how a tropical cyclone forms.

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..... [2]

[Total: 21]

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