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ENVIRONMENTAL MANAGEMENT **0680/22**

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 **24** pages. Any blank pages are indicated.

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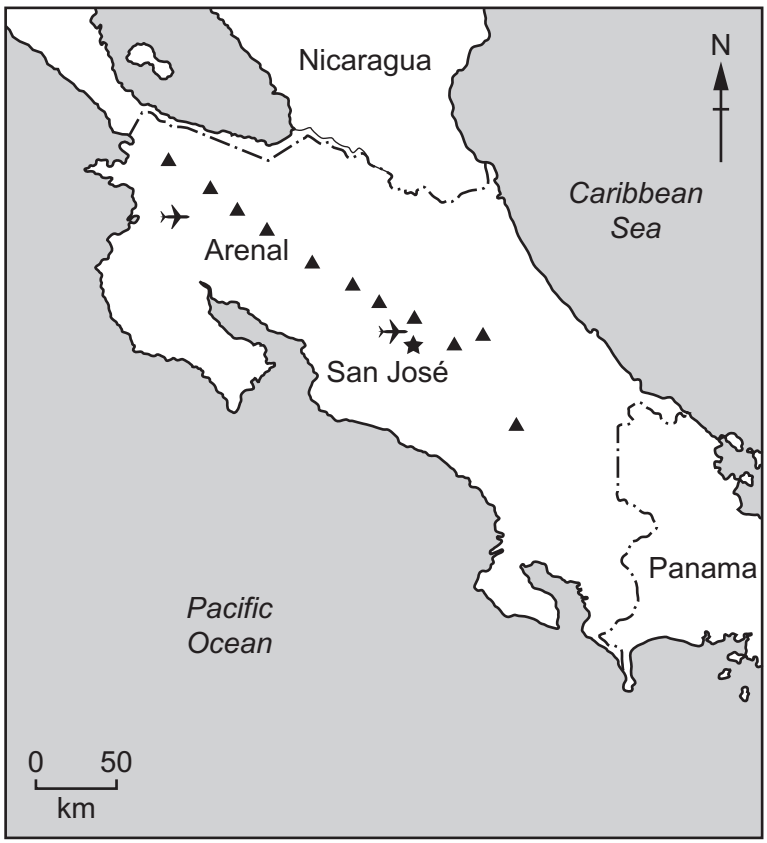
world map showing the location of Costa Rica



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 a 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

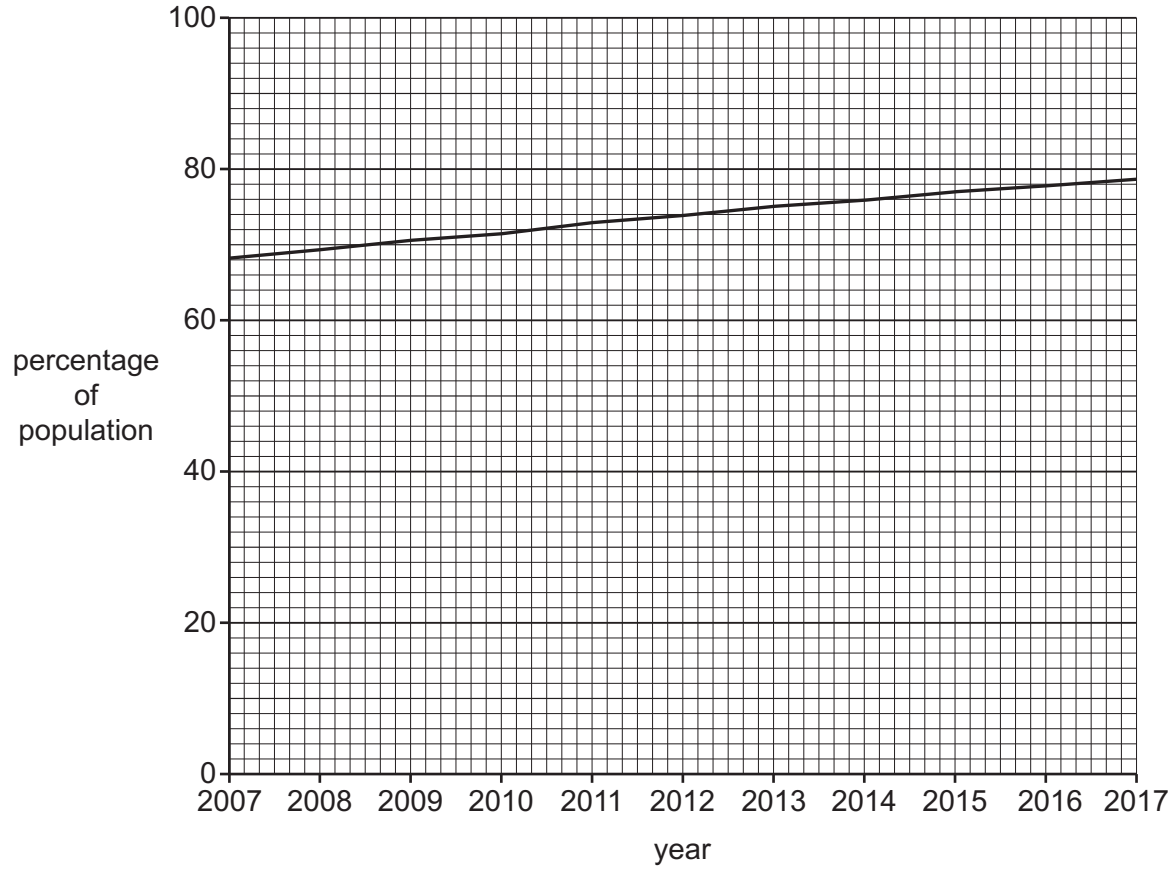
Main economic activities of Costa Rica: ecotourism and agricultural production including bananas, coffee, sugar and beef

Costa Rica's rich biodiversity attracts many ecotourists. The government has invested in education, healthcare, electricity, clean water and sanitation. However, 24 362 people do not have electricity, and 21.7% of the population live in poverty.

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[Turn over

1 **(a)** The graph shows the percentage of the population of Costa Rica living in urban areas between 2007 and 2017.



(i) Describe the trend shown in the graph.

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..... [2]

(ii) In 2019, there were 339 581 people living in the capital city, San José.

Calculate the percentage of the population of Costa Rica living in San José in 2019.

.....% [1]

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(iii) Suggest **two** advantages of living in urban areas compared with rural areas.

1 .....

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2 .....

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[2]

(iv) Suggest reasons why some people living in rural areas are concerned about urbanisation.

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..... [2]

(v) In the last sixty years, life expectancy in Costa Rica has increased rapidly.

Suggest **two** reasons for this. Explain each reason.

reason 1 .....

explanation .....

.....

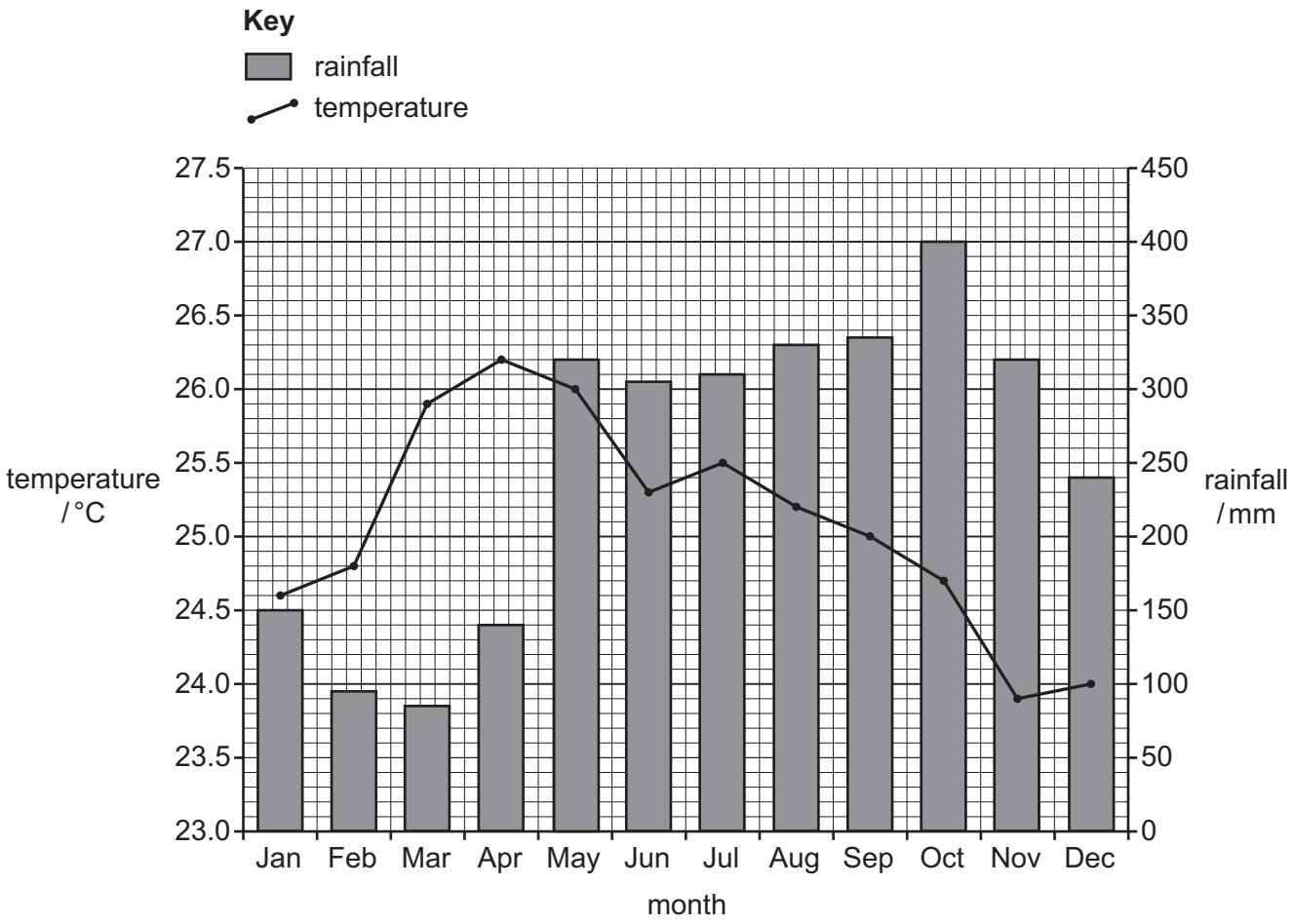
reason 2 .....

explanation .....

.....

[4]

(b) The graph shows climate data from a weather station in Costa Rica for one year.



(i) Use the climate data to suggest which months are in the wet season in Costa Rica.

from ..... to ..... [1]

(ii) The annual rainfall range is the difference between the maximum and minimum rainfall values.

Calculate the annual rainfall range at this weather station.

..... [2]

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(iii) Use the climate data to suggest ways that the climate affects the growing of crops in Costa Rica.

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..... [4]

(c) Large areas of forested land in Costa Rica have been cleared of trees for timber, growing crops and grazing livestock.

The photograph shows deforested land.



(i) Deforestation can cause soil erosion.

Describe the impacts of soil erosion.

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..... [3]

(ii) Explain how intercropping and bunds can reduce soil erosion.

intercropping .....

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bunds .....

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[4]

(iii) The table shows the total area of forest cover in Costa Rica between 1940 and 2019.

year	1940	1960	1980	1990	2000	2005	2010	2019
total area of forest cover / km^2	38 295	27 062	12 212	25 640	23 760	24 910	26 050	38 550

Use the data to describe how the total area of forest cover in Costa Rica changed between 1940 and 2019.

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..... [3]

(iv) A scheme called 'payments for ecosystem services' (PES) was introduced in Costa Rica to protect forested land.

Three local landowners talk about the PES scheme.

Landowner **A**:

I am paid by the government to not cut down trees for timber on my land. I have decided not to grow coffee for export because I can earn more money in the PES scheme.

Landowner **B**:

There are lots of forms to fill in every year to stay in the PES scheme. The scheme is not compulsory. It's up to me whether I stay in the scheme.

Landowner **C**:

I use the regular PES payment to feed my family. I make a lot of money as a tourist guide in the forest.

Discuss whether the PES scheme is a good environmental management strategy.

Use information from the comments of the three local landowners to support your view.

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..... [4]

(v) Explain why climate change is an impact of deforestation.

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..... [4]

(vi) Costa Rica accounts for only 0.03% of the Earth's land but contains 6% of the Earth's biodiversity.

Suggest **one** reason why people are concerned that climate change could affect biodiversity in Costa Rica.

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..... [1]

[Total: 37]

2 **(a)** The fact sheet shows information on the blue-sided treefrog.

The Blue-sided Treefrog



The blue-sided treefrog is a brightly-coloured, green frog with blue sides. It can change colour at night to a darker green. It is an endangered species in Costa Rica.

This species of treefrog is nocturnal, which means it is only active at night. It prefers cooler temperatures and is damaged by ultraviolet radiation.

The treefrogs lay eggs on leaves. When the eggs hatch, they release tadpoles. The tadpoles fall into pond water and grow into adult frogs.

The adult frogs feed on invertebrates such as crickets. The crickets feed on grass and leaves. Snakes and birds are the main predators of treefrogs.

Collecting blue-sided treefrogs is illegal. However, some treefrogs are still collected and sold as pets.

A popular tourist activity in Costa Rica is night-walking in forested areas to look for treefrogs.

(i) Use the fact sheet to write a food chain for the blue-sided treefrog which includes **four** trophic levels.

..... [2]

(ii) Suggest how the ability to change colour at night is a benefit to the treefrog.

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..... [1]

(iii) Disease and climate change are two reasons why the blue-sided treefrog is no longer found in some of the national parks and reserves in Costa Rica.

Suggest **other** reasons why the blue-sided treefrog is no longer found in these areas.

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..... [2]

(b) A student reviews some online data about captive breeding programmes for the blue-sided treefrog.

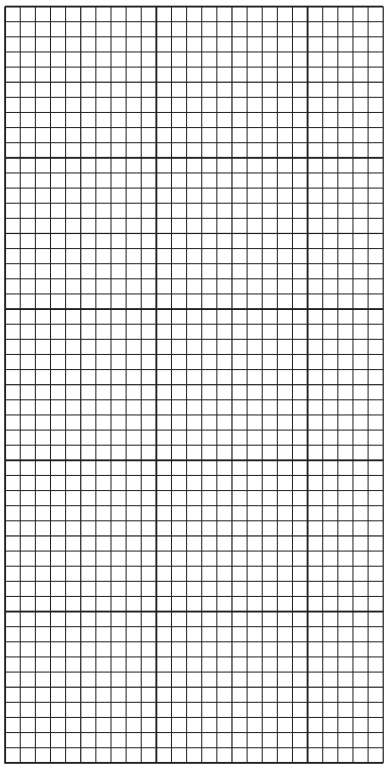
The table shows the data.

breeding programme	percentage of eggs hatching into tadpoles	percentage of tadpoles growing into adult frogs	percentage of adult frogs still living after one year
A	30	43	45
B	52	67	12
C	88	75	92
D	10	32	42

(i) Identify which captive breeding programme is the **least** successful at hatching eggs into tadpoles.

..... [1]

(ii) On the grid, plot a bar chart for the percentage of adult frogs still living after one year for the four breeding programmes.



[4]

(iii) Suggest a limitation of the data set in the table.

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..... [1]

(c) The blue-sided treefrog is killed by a disease caused by a fungus.

Most blue-sided treefrogs are now found living near small ponds in urban areas. Some of these ponds are very polluted.

A student has a theory that the fungus that kills the treefrogs cannot survive in these polluted ponds.

The student tests this theory by:

- visiting five ponds during the night
- analysing the pond water for common pollutants
- testing the pond water for the fungus
- using a quadrat to sample an area all round the edge of the pond
- counting the number of blue-sided treefrogs.

(i) The five ponds are chosen at random.

State **one** benefit of choosing these ponds at random.

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..... [1]

(ii) The student repeats the method on three different days.

Suggest why this is good sampling practice.

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..... [1]

(iii) Suggest **two** limitations of this method.

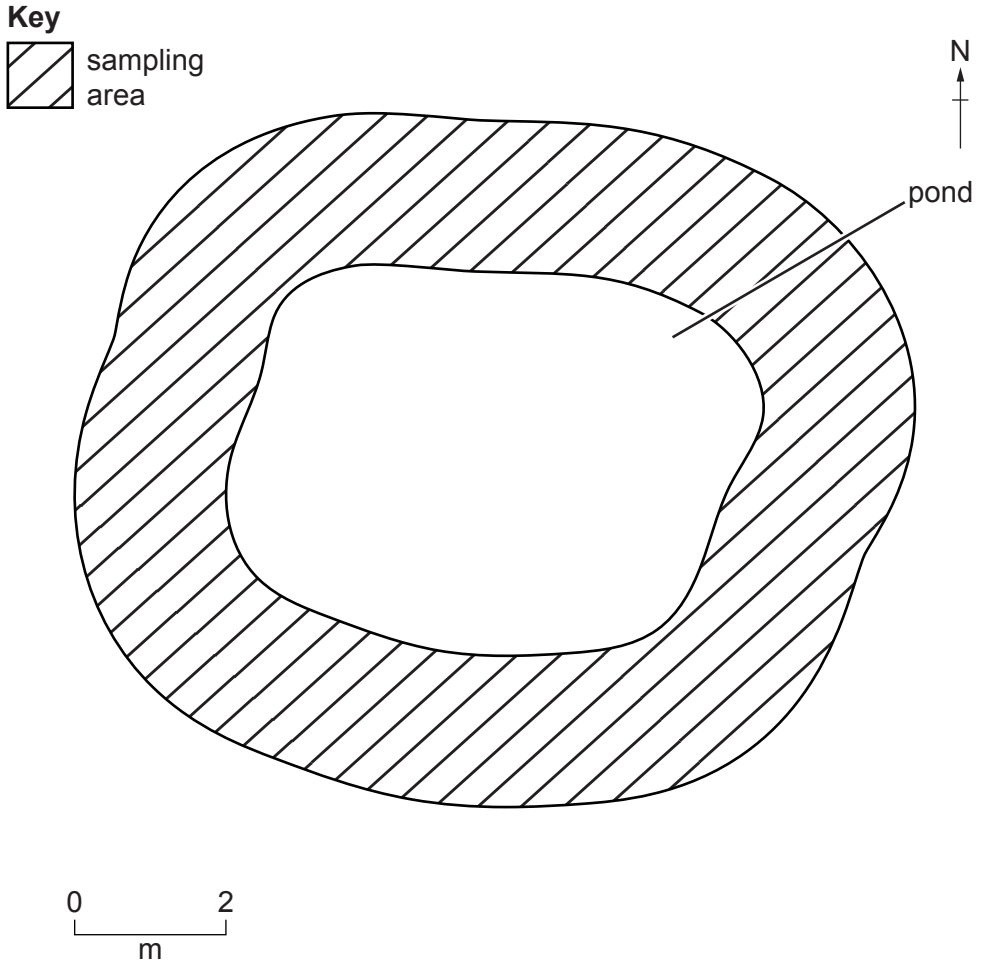
1 .....

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2 .....

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[2]

(iv) The diagram shows a pond where blue-sided treefrogs live.



Describe how you could use a quadrat to record the number of blue-sided treefrogs at this pond.

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..... [4]

[Total: 19]

3 **(a)** The photograph shows the Arenal Volcano and the town of La Fortuna in Costa Rica.



For nearly 500 years, the Arenal Volcano was dormant. In 1968, it erupted.

Over 15 km^2 of land was completely buried with rocks and lava. An area of 232 km^2 was covered by ash. Three villages on the west side of the volcano were buried and 87 people were killed.

The table shows the human population in the Arenal region in 2019.

distance from the Arenal Volcano / km	population
< 5	3429
5–10	15643
11–30	96512
31–100	3027485

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(i) Suggest economic impacts for people living in the Arenal region if the Arenal Volcano erupts again.

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..... [4]

(ii) Costa Rica has a disaster preparation plan that will be used if the Arenal Volcano erupts again.

Suggest a suitable disaster preparation plan for reducing the impact of a volcanic eruption.

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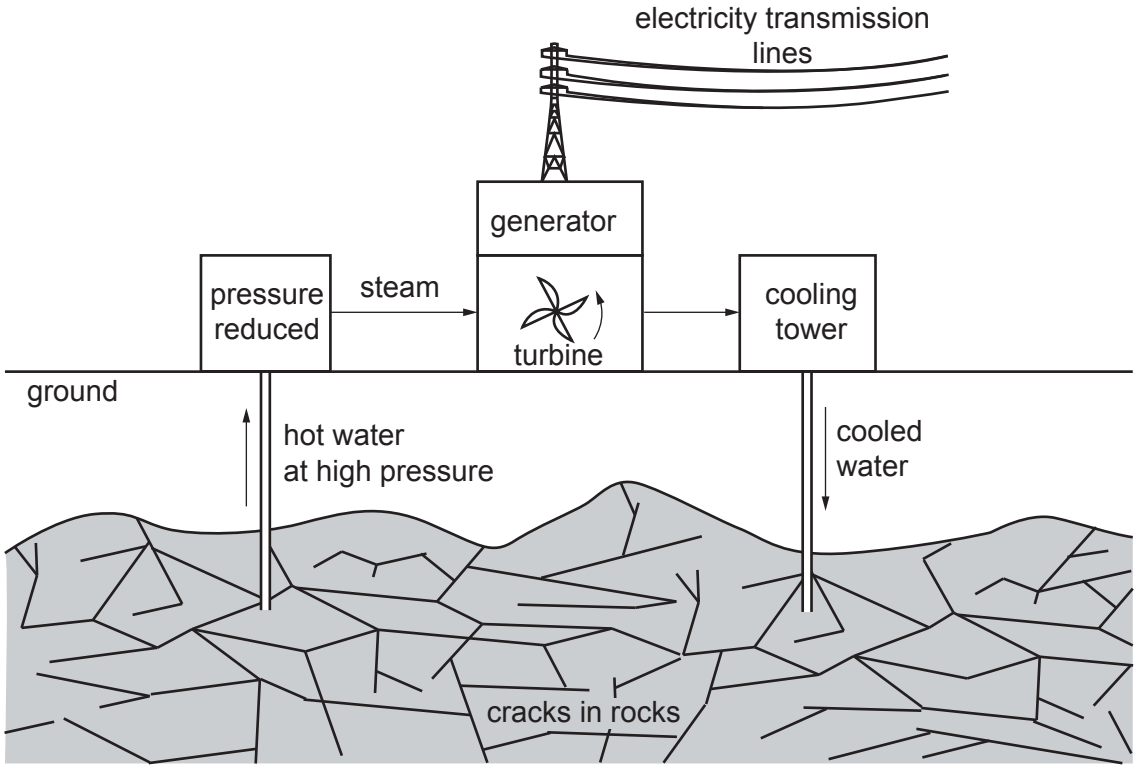
.....

..... [3]

(b) Living near a volcano can provide opportunities for people.

Geothermal power is one of these opportunities.

The diagram shows how geothermal power is used to generate electricity.



(i) Use the diagram to describe how geothermal power is used to generate electricity.

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..... [4]

(ii) Only 30 countries in the world use geothermal power to generate electricity.

Suggest **two** reasons why only a small number of countries use geothermal power to generate electricity.

1 .....

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2 .....

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[2]

(iii) Suggest other opportunities for people living near volcanoes.

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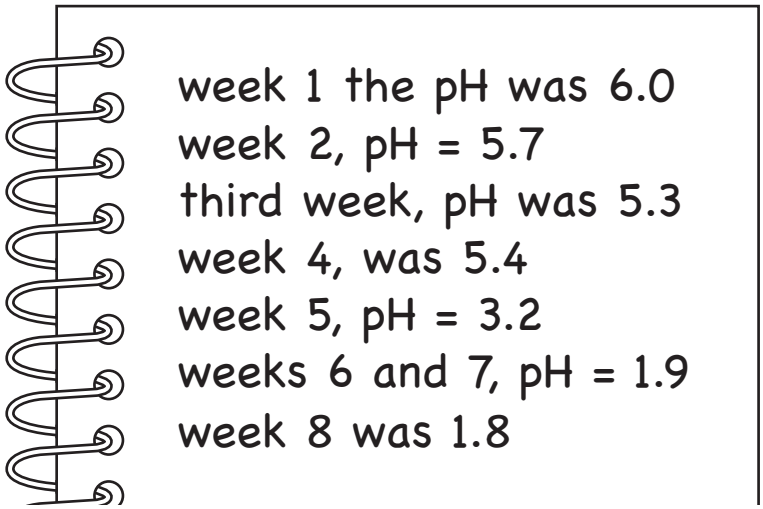
..... [2]

(c) Volcanoes emit sulfur dioxide gas. There is an increase in the emissions of sulfur dioxide before a volcanic eruption.

The sulfur dioxide mixes with water to form sulfuric acid.

A scientist monitors the acidity of a small lake near the Arenal Volcano by recording the pH values of samples of lake water.

The scientist records the results in a notebook.



(i) Present the data from the notebook in a suitable table.

[3]

(ii) The scientist concludes that the Arenal Volcano is becoming more active.

State whether you agree with the scientist's conclusion. Explain your answer.

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..... [2]

(iii) The pH of an ecosystem is an abiotic component.

State the names of **two** other abiotic components of an ecosystem.

1 .....

2 .....
[2]

(d) Volcanoes are a natural source of sulfur dioxide.

(i) State **one** human activity that emits sulfur dioxide.

..... [1]

(ii) Sulfur dioxide in the atmosphere causes acid rain. Acid rain can cause acidification of lakes.

State **one** other impact of acid rain on the environment.

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..... [1]

[Total: 24]

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