Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

5014109167

ENVIRONMENTAL MANAGEMENT **5014/21**

Paper 2 Management in context **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **21** printed pages and **3** blank pages.

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[Turn over

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world map showing the location of Madagascar

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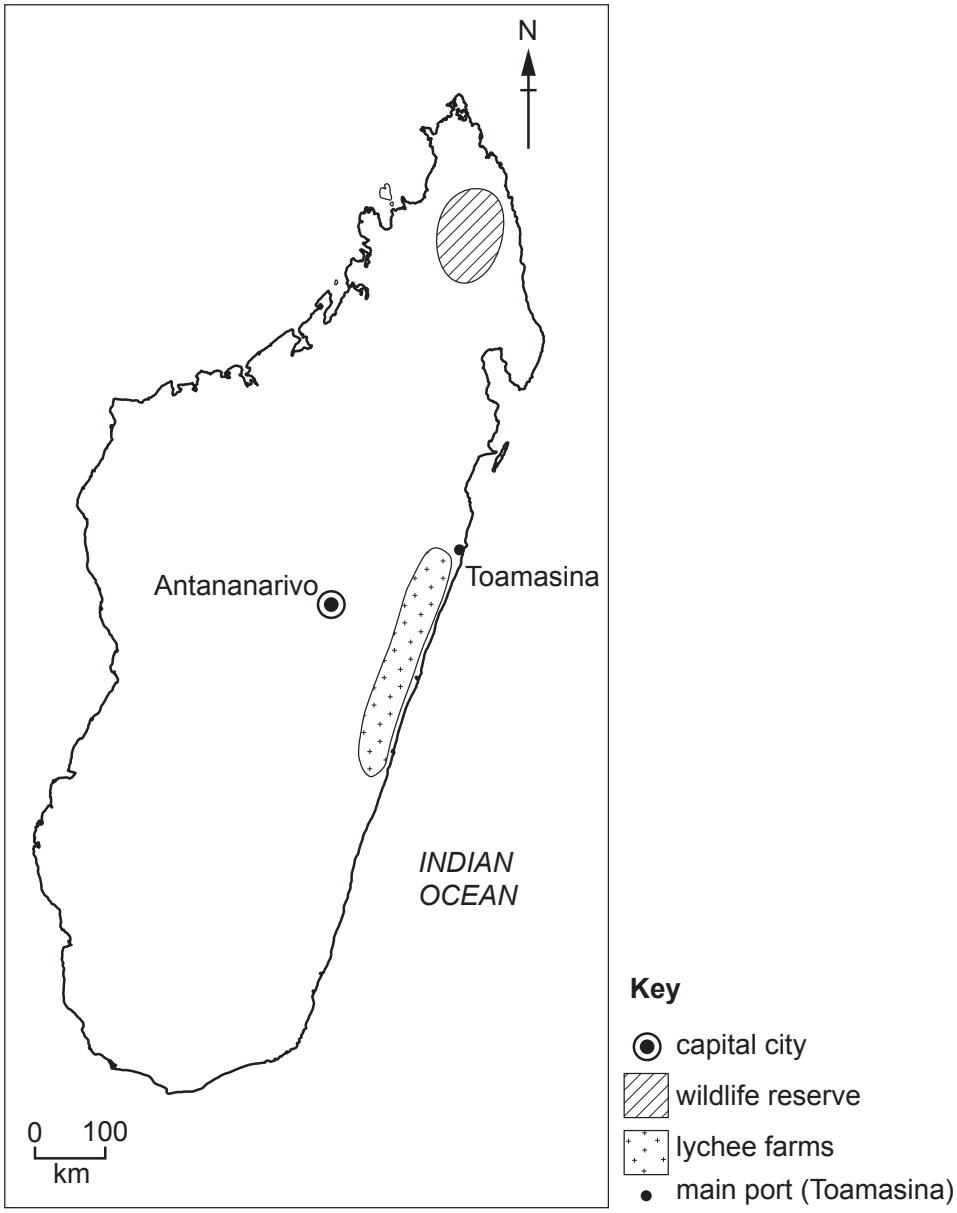
map of Madagascar



Area of Madagascar: 587 041 km^2

Population: 25.6 million (in 2017)

Children per woman: 4.12

Life expectancy: 65.9 years

Currency: Malagasy ariary (2940 MGA = 1 USD)

Languages: French, Malagasy, English

Climate of Madagascar: tropical along the coast, temperate inland, very little rain (arid) in the south

Terrain of Madagascar: narrow coastal plains and mountains inland

Main exports of Madagascar: agricultural products (coffee, lychees, vanilla and sugar), chromite, petroleum products and textiles

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Madagascar is the fourth largest island in the world. Agriculture is the main economic activity. Mining and oil exploration are a developing part of the economy. The island has a high biodiversity including many endemic species, which are species found nowhere else in the world. There is great potential for sustainable tourism. Madagascar has very few roads and many people have a low standard of living.

1 **(a)** **(i)** Explain the meaning of the term *sustainable tourism*.

.....

.....

.....

..... [2]

(ii) Suggest reasons why the government and local people want the number of tourists to increase in the future.

government .....

.....

.....

local people .....

.....

.....
[3]

(iii) List **three** environmental problems that can be caused by large numbers of tourists.

1 .....

2 .....

3 .....
[3]

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(b) The photograph shows two lemurs. Lemurs are an endemic species in Madagascar.

Madagascar has 101 different species of lemur. Each species of lemur is adapted to a particular habitat. Many tourists visit Madagascar to see these lemurs.

The habitat of many species of lemur has been greatly reduced in recent years.

A recent survey of Madagascar found that 47 species of lemur are at high risk of extinction and the remaining species are at medium or low risk of extinction.

Calculate the percentage of all lemur species in Madagascar at medium or low risk of extinction.

..... % [2]

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(c) An area of mountainous rainforest covering 32 000 hectares has been set up as a wildlife reserve to protect 12 different species of lemur. Some tourists visit the wildlife reserve after a long journey over a rough track. There is a small visitor centre. If tourists stay overnight they have to sleep in a tent and bring their own food.

The following activities also take place in this reserve:

- plant and animal populations are surveyed by scientists
- trees are replanted by local people
- methods of sustainable farming are taught to local people
- fuel-efficient cooking stoves are promoted.

(i) Suggest reasons why the tourists visiting this reserve only have a low impact on the natural environment.

.....

.....

.....

.....

.....

..... [3]

(ii) Describe **two** ways in which sustainable farming can take place in this reserve.

1 .....

.....

2 .....

.....
[2]

(iii) Local people who live in the reserve are encouraged to use solar-powered cooking stoves and fuel-efficient wood-burning stoves. These stoves reduce emissions of carbon dioxide.

Suggest **two** other benefits to local people of using these stoves.

1 .....

.....

2 .....

.....
[2]

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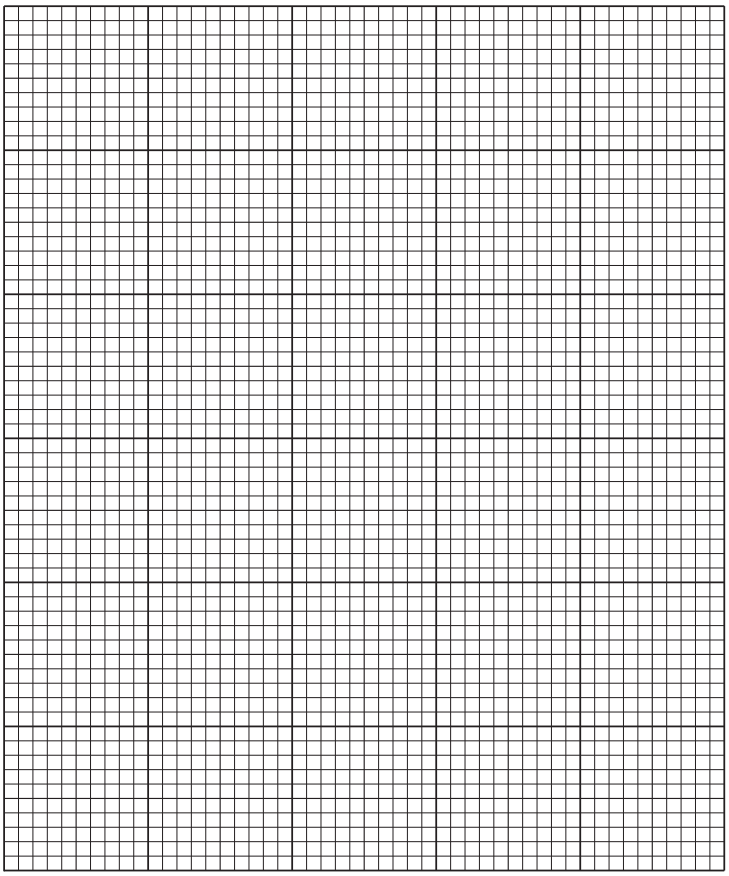
(d) The table shows the estimated reduction in carbon dioxide emissions over a seven-year period for one region of Madagascar.

year	estimated reduction in carbon dioxide emissions / thousand tonnes
1	5
2	14
3	26
4	40
5	57
6	75
7	94

(i) Plot a line graph of the data.



[4]

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(ii) Use the graph to predict the estimated reduction in carbon dioxide emissions in year 8.

..... thousand tonnes [1]

(iii) Suggest why the reduction in carbon dioxide emissions is important to Madagascar.

.....

..... [1]

(iv) Wood is a type of biofuel.

Name **two** other types of biofuel.

1 .....

2 .....
[2]

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(e) There are about 800 different species of orchid plant found only in Madagascar. Many of these species are under threat from people collecting plants illegally.

A survey to monitor the population of different orchid species in the wildlife reserve is done every two years.

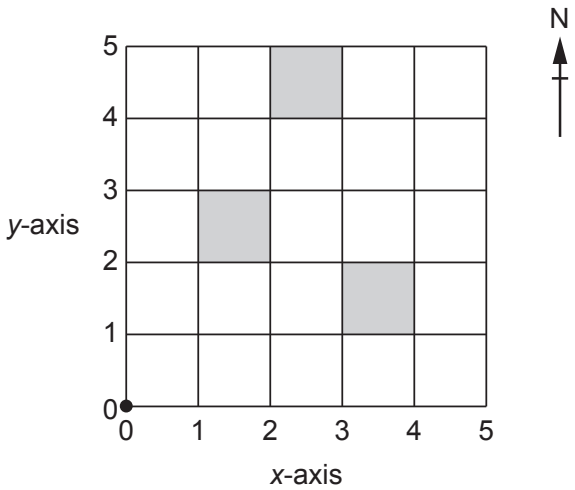
The following method is used:

- select a sample site at random on a map of the reserve
- use a global positioning system (GPS) to find this sample site
- use a tape to mark out a grid 5 m × 5 m
- use a calculator to generate five pairs of random numbers
- use the random numbers to mark five quadrat positions inside the grid
- the first random number represents the distance along the *x*-axis of the grid and the second random number represents the distance along the *y*-axis of the grid
- use a quadrat to record the number and the species of orchid plants at each position.

	random number pairs	
quadrat position	***x*-axis**	***y*-axis**
1	2	4
2	1	2
3	3	1
4	4	3
5	1	0

The first three quadrat positions have been shaded on the grid.

Complete the grid to show quadrat positions 4 and 5.



● GPS position

[2]

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(f) The method was repeated every two years. The results over a four-year period are shown in the table.

To help with biological classification, different species of closely related orchids are grouped together.

year of survey	group A		group B		group C	
	number of species	number of plants	number of species	number of plants	number of species	number of plants
0	8	107	5	43	13	134
2	8	111	5	24	7	85
4	8	120	3	7	7	91

(i) State the group of orchids, **A**, **B** or **C**, which has lost the largest number of species over four years.

group ..... [1]

(ii) Which group of orchids, **A**, **B** or **C**, has been **least** affected by human activity?

Give a reason for your answer.

group .....

reason .....

.....
[1]

(iii) Suggest which group of orchids, **A**, **B** or **C**, is **most** likely to be being collected illegally. Give a reason for your answer.

group .....

reason .....

.....
[1]

(iv) Many species of orchid only grow attached to tree trunks. The survey only counted orchid plants found on the ground and up to two metres up tree trunks.

Explain why this survey method is likely to show if illegal collecting of orchid plants has happened.

.....

.....

.....

..... [2]

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(v) Suggest reasons why it is difficult to stop illegal plant collecting in the wildlife reserve.

.....

.....

.....

.....

.....

..... [3]

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(g) The photograph shows an orchid plant growing in shady conditions in the wildlife reserve.

The leaves of this orchid plant are dark green in colour.

(i) State the name of the green pigment in leaves.

..... [1]

(ii) Suggest why the leaves of this orchid plant have a large quantity of the green pigment.

.....

.....

.....

..... [2]

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(h) The table shows climate data from a weather station in the wildlife reserve.

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
average temperature / °C	26	26	25	25	24	22	21	21	22	24	24	25
average rainfall / mm	366	376	452	399	364	282	302	203	132	99	117	262

(i) Calculate the average annual rainfall at this weather station.

..... mm [1]

(ii) Use the data to explain why orchid plants grow and flower all year round in this wildlife reserve.

.....

.....

.....

.....

.....

..... [3]

[Total: 42]

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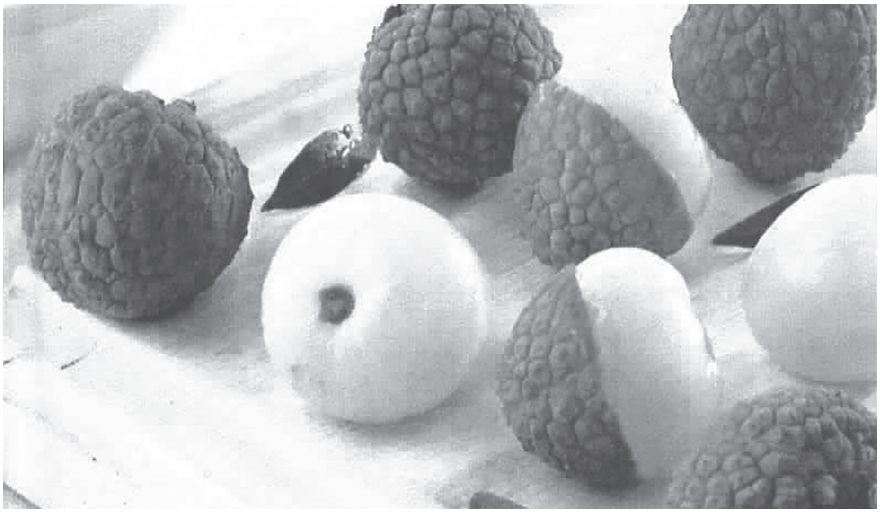
2 **(a)** The photograph shows some lychee fruits.



Madagascar is the biggest exporter of lychees to Europe. The lychees grow on trees. The lychees are picked by up to 30 000 families in October and November each year. About 3000 collectors transport the lychees to the port of Toamasina. The lychees are packed in boxes before being exported.

Ships begin loading lychees in November. Up to 20 000 tonnes are exported each year to Europe.

One person said,

> I like picking lychees. This is when I earn most of my annual income. At the end of the year I have many things to pay for, especially school fees.

(i) Suggest reasons why the government wants to encourage small farms to grow lychee trees.

.....

.....

.....

.....

.....

..... [3]

(ii) Suggest why lychees are exported to Europe by sea.

.....

..... [1]

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(b) The boxes of lychees are exposed to sulfur dioxide gas to kill bacteria and fungi. The boxes are then transported in cool conditions in ships.

(i) Suggest why killing the bacteria and fungi is important.

.....

..... [1]

(ii) The cool conditions in the ships reduce the rate of respiration of the lychees.

Describe the process of respiration.

.....

.....

.....

.....

.....

..... [3]

(c) A student wanted to investigate the packing of lychees for export.

The student:

- selected ten lychee fruits at random
- weighed each fruit
- separated out the lychee parts into edible flesh, seed and skin
- weighed each of these parts.

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The results are shown in the table.

	mass / g			
fruit	**whole fruit**	**edible flesh**	**seed**	**skin**
1	43	28	8	7
2	45	25	12	8
3	38	19	11	8
4	37	17	11	9
5	39	23	9	7
6	41	25	10	6
7	42	23	12	7
8	44	22	13	9
9	36	16	10	10
10	39	23	7	9
average	40.4	22.1	10.3	.....
range	9	12	6	.....

(i) Complete the table by calculating the average and the range for skin. [2]

(ii) Each box of lychees for export has a minimum of 2.5 kg of lychees.

Calculate the average number of lychees in **one** box.

Give your answer to the nearest whole number.

..... [2]

(iii) Calculate the average percentage of the whole fruit that is seed.

Give your answer to three significant figures.

..... % [2]

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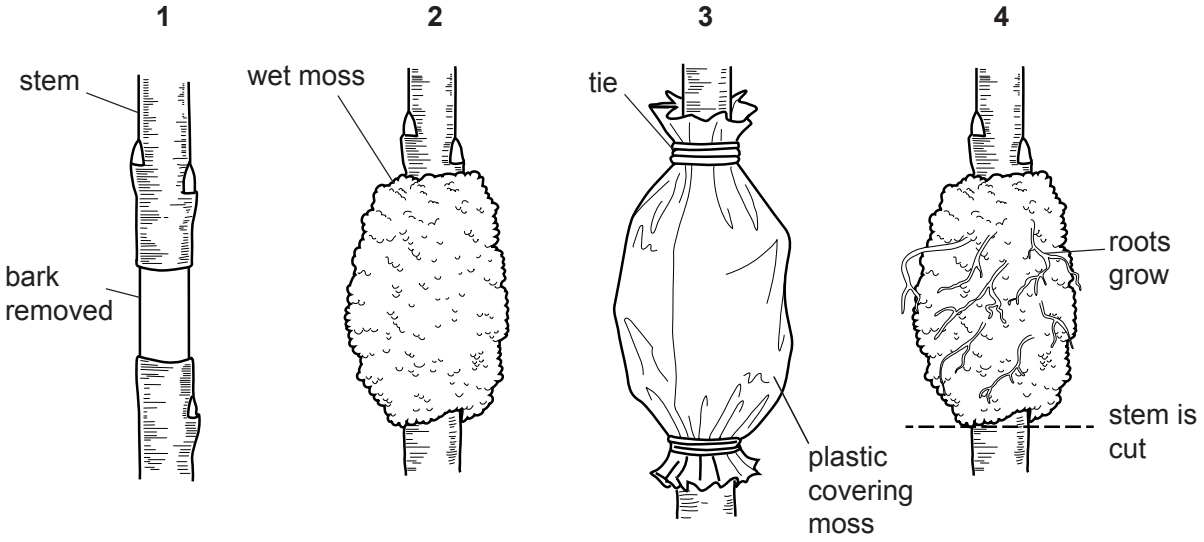
(iv) New lychee trees can be produced by a method called air layering.

The diagram shows the stages of air layering.



Only some lychee trees are selected to produce new lychee trees using air layering.

Suggest **two** factors farmers would use to select lychee trees for air layering.

1 .....

.....

2 .....

.....

[2]

(d) The east coast of Madagascar is regularly hit by tropical cyclones.

(i) Describe how a tropical cyclone is formed.

.....

.....

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.....

.....

..... [3]

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(ii) Describe **four** ways tropical cyclones cause damage.

1 .....

.....

2 .....

.....

3 .....

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4 .....

.....

[4]

(iii) Describe **three** ways of managing the impacts after a tropical cyclone has hit a coastal region.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) Many lychee trees are grown near the coast of Madagascar and are often damaged by tropical cyclones. When damaged, the lychee trees do not produce fruit for three years.

Suggest **one** way farmers could reduce the risk of damage to their lychee trees.

.....

..... [1]

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(f) The photograph shows some lychee trees.

An agricultural adviser said,

> Many of the lychee trees are old. Very few farmers are planting new trees.

A student wanted to collect information to confirm the agricultural adviser's opinion.

The student produced the following questionnaire.

question
1. How many lychee trees do you have?
2. How many kg of fruit do you pick each year?
3. How old are your trees?
4. How many new trees have you planted in the last 3 years?

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(i) The student did a pilot survey with a few farmers before giving the questionnaire to a larger sample of farmers.

Explain why the student did this.

.....

.....

.....

..... [2]

(ii) The student decided to change the style of the questionnaire.

question			
1. How many lychee trees do you have?	1– 49	50–100	100+
2. How many kg of fruit do you pick each year?	1– 99	100–200	200+
3. How old are your trees in years?	1–9	10–30	30+
4.			
.....			

Complete the questionnaire by rewriting question **4** in the same style as questions **1**, **2** and **3**. [1]

(iii) Explain the advantages of collecting information using the new style of questionnaire.

.....

.....

.....

..... [2]

(iv) Explain why growing lychee trees will **not** contribute to the availability of food for the population of Madagascar.

.....

.....

.....

..... [2]

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(v) Suggest **one** way farmers can earn money from the old lychee trees when they stop producing fruits.

.....

..... [1]

(g) A lychee tree produces separate male and female flowers.

Describe how insects help flowers develop into fruits.

.....

.....

.....

.....

.....

..... [3]

[Total: 38]

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