Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

NATURAL ECONOMY 0670/04

Paper 4 Alternative to Coursework

October/November 2003

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 on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
Study the appropriate source materials before you start to write your answers.
Write your answers in the spaces provided on the question paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
Credit will be given for appropriate selection and use of source data in your answers and for relevant interpretation of these data. Suggestions for data sources are given in some questions.
You may use the source data to draw diagrams and graphs or to do calculations to illustrate your answers.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use

This document consists of **14** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
[Turn over

Fig. 1 World map

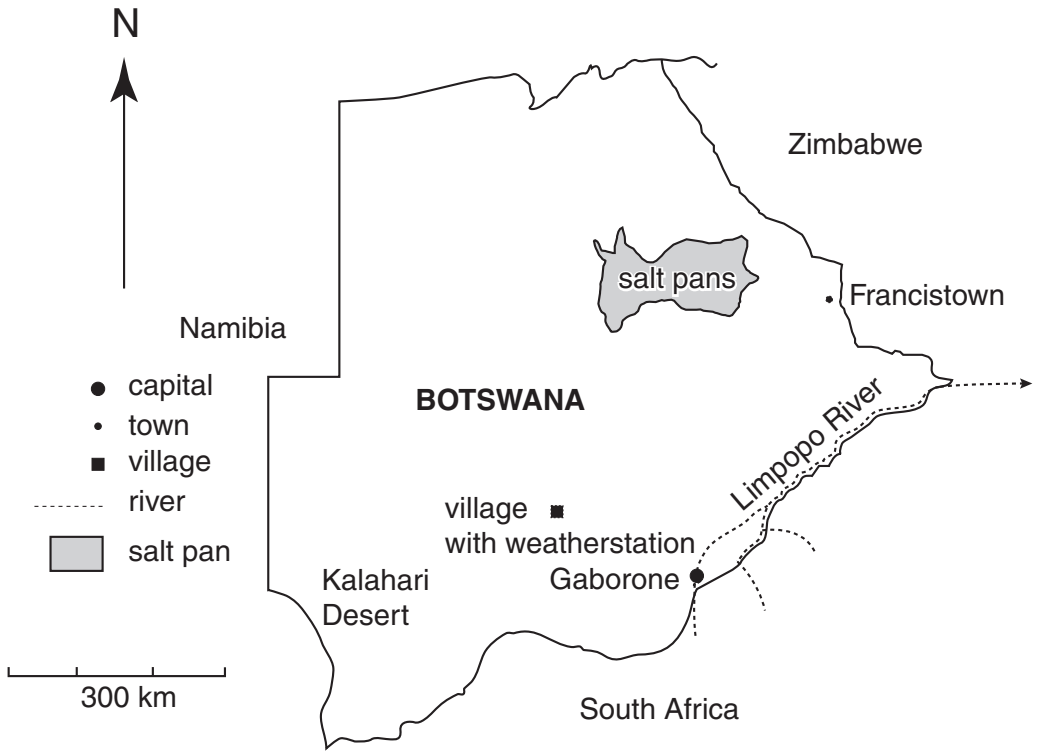

Fig. 2 Botswana

1 Botswana is a country covering 582 000 sq km in southern Africa. It has a population of 1.6 million people.

Most of Botswana is a vast wilderness – savannas, deserts, wetlands and salt pans. A salt pan is formed when rain falls and collects in low lying areas. The water evaporates leaving a flat salty crust.

Most of the population lives along the eastern edge of the country. There are many small villages and few roads. Botswana's main products are cattle, goats, maize, sorghum, diamonds, nickel and copper.

Less than 1% of the land area is used for growing crops.

Month	Temperature (°C)		Average monthly rainfall (mm)
	Average monthly minimum	Average monthly maximum	
January	18	30	107
February	18	30	79
March	16	29	71
April	13	28	18
May	9	26	5
June	5	23	3
July	5	24	0
August	7	26	0
September	12	30	0
October	16	32	23
November	18	32	56
December	18	30	86
	Average 12.9	Average ……	Total ……

Fig. 3 Weather conditions at Francistown

(a) Complete the table, Fig. 3, to show the average maximum temperature for the year and the total rainfall. [3]

(b) Using information in the table complete the following:

the wettest month is usually .....

the dry season is between the months of ..... and ..... [3]

(c) Suggest in which month each of the following was likely to have happened;

(i) the lowest temperature of –4 °C was recorded,

.....

(ii) the highest temperature of 42 °C was recorded.

.....
[2]

There are very few accurate records of weather conditions in large parts of Botswana. It is thought that there is less rainfall in the south-west as well as higher daily maximum temperatures.

You are asked to start recording the weather in a village 500 km south-west of Francistown. The equipment is shown in Fig. 4.

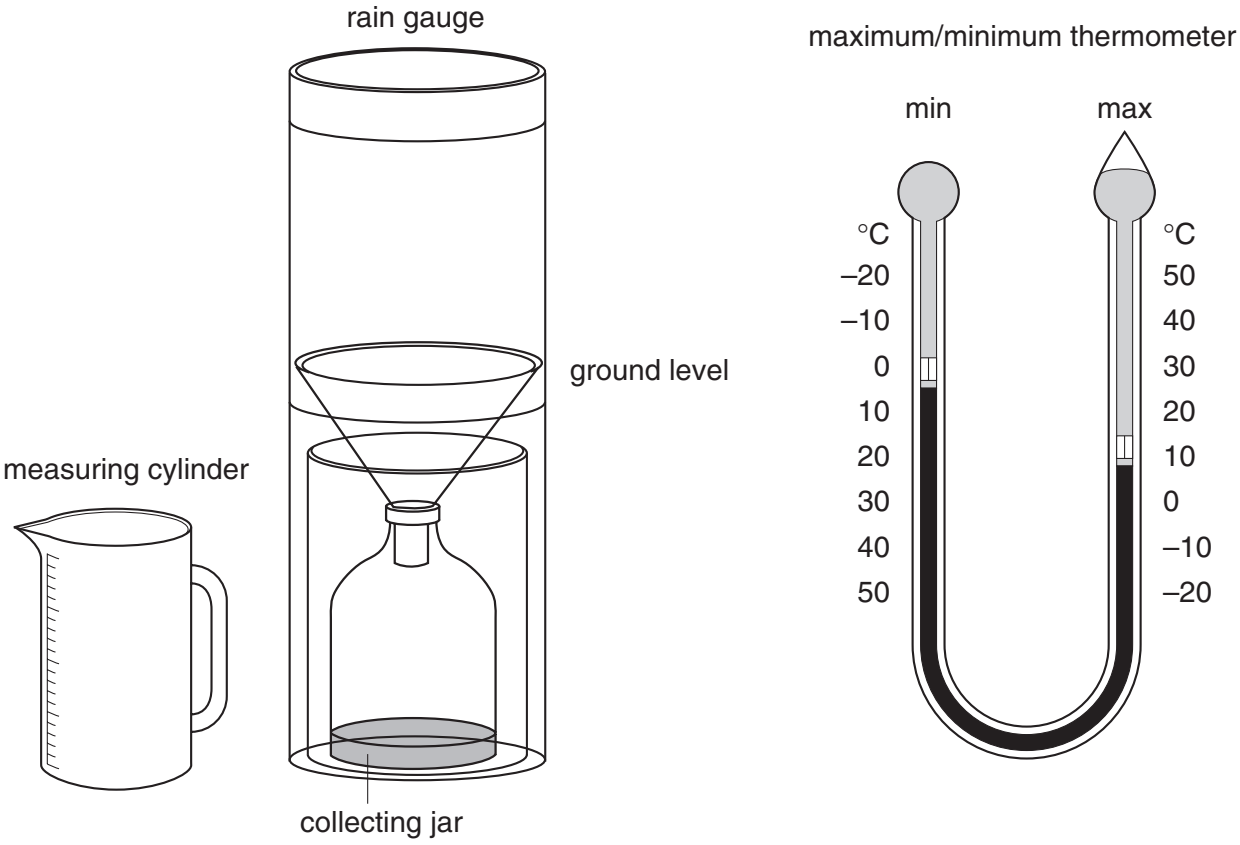

Fig. 4 Measuring weather

(d) **(i)** Describe, in detail, how to take a reading of

rainfall, ...

.....

.....

maximum and minimum temperature. .....

.....

..... [3]

(ii) The villagers start taking readings from the instruments once a day. In the space below draw a table that could be used to record the weather for one week.

[3]

2 A student in the north-east of Botswana was asked to estimate how much wood could be harvested from a small experimental plot of trees 50 m x 50 m in area.

A fence had been used to protect the young trees from grazing animals.

Part of the student's report is shown below.

- I decided that I could not count every tree in the total area as it would take too much time.
- I used a tape measure and a compass to mark out a sample area of 5 m x 5 m.
- I counted all the trees in this sample area.
- I found out that the average height of the trees in my sample was 4.0 m. They had been growing for six years.
- I marked out another four sample areas 5 m x 5 m in different parts of the fenced plot.
- The total number of trees I counted was 45 in the total sampled area.

  The fenced plot is 20 times larger than the total area sampled.
- This allowed me to calculate the likely total number of trees in the experimental plot.

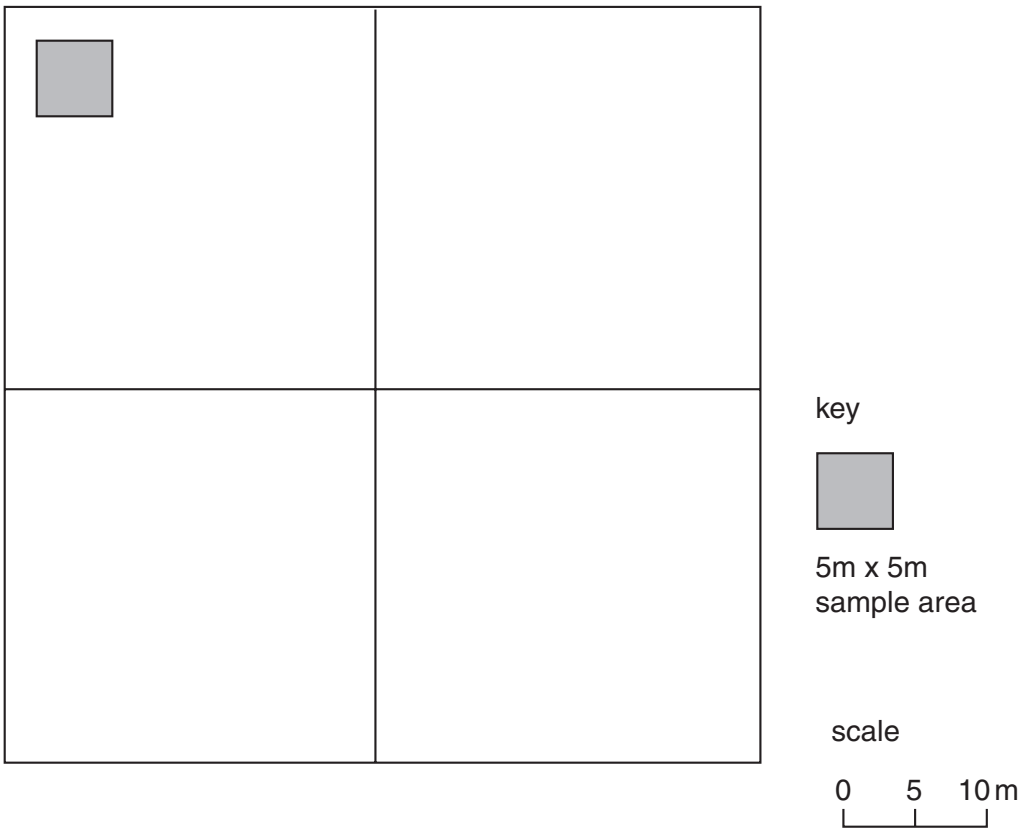

Fig. 5 Field diagram – fenced plot of trees

(a) **(i)** Draw, on the plan of the fenced plot (Fig. 5), four further sample areas in positions likely to give a reasonable result. [1]

(ii) Why did the student use more than one sample area?

..... [1]

(b) Calculate the total number of trees in the fenced plot.

..... [1]

(c) Suggest how the student estimated the height of the trees.

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..... [2]

(d) A villager cut down one tree, of average height, for the student. The weight of the wood was 8 kg. Calculate the total weight of all the trees using your answer from part **(b)**.

.....

..... [1]

(e) **(i)** Give **three** uses of wood in village life.

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.....

..... [3]

(ii) Describe, **in detail**, the tasks which would have to be carried out **in the first year** of growing a plot of trees near the village.

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..... [4]

[Turn over

(f) The student wrote some guidelines for the villagers so that by growing plots of trees they could achieve sustainable development that could be followed by people in other villages.

Guideline One

Plots of trees must be regularly checked by villagers.

Guideline Two

Trees must not be harvested until they are at least six years old.

Guideline Three

Trees must not all be cut down at the same time.

Suggest three more guidelines to help the villagers. Give a reason for each of your guidelines.

Guideline four .....

.....

Reason .....

.....

Guideline five .....

.....

Reason .....

.....

Guideline six .....

.....

Reason .....

..... [6]

3 Cowpeas are a very important food for humans. Cowpeas can be grown on thin soils in areas of low rainfall. The seeds contain up to 30% protein and the rest of the plant can be fed to animals.

A scientist recorded the harvest and use of cowpeas over five years on a small farm.

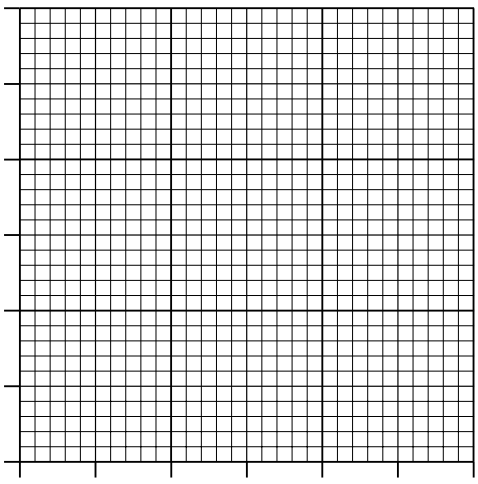
Year	Cowpea harvest (kg)	Cowpeas eaten (kg)	**X** Stored surplus for future use (kg)	**Y** From previous store or bought in (kg)
1998	600	580	20	0
1999	460	700	0	240
2000	440	540		
2001	750	550		
2002	1000	700		
TOTAL	3250			

Fig. 6

(a) **(i)** On the table (Fig. 6) show the total cowpeas eaten between 1998-2002. [1]

(ii) Complete the columns labelled **X** and **Y**. [1]

(b) Draw a graph of the **harvest** weights over five years.



[4]

(c) Cowpeas are sold at local markets. In which year do you think cowpeas had the highest price? Explain your answer.

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..... [2]

Striga is a parasitic weed that feeds from the roots of sorghum, maize and cowpeas. It is a very serious problem in many African countries.

The only method of control is to stop the striga plant flowering and spreading its seeds.

Recently, a variety of cowpea being grown in Botswana has been found to be resistant to attack by striga.

All varieties of cowpea plants have swellings on their roots. These swellings have bacteria inside to fix nitrogen from the air. The roots of some varieties cannot be attacked by striga. Any striga seeds already in the field start to grow but cannot feed off the roots, so they die.

A student carried out the following experiment. Field soil containing striga seeds was used in every container.

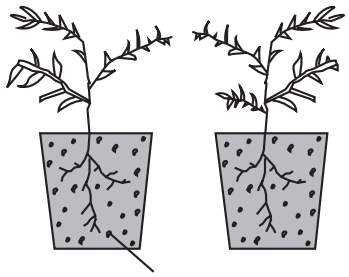
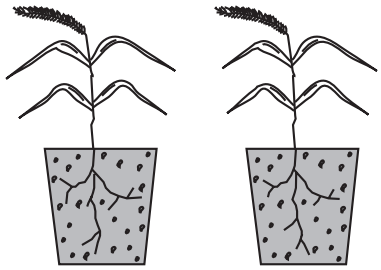
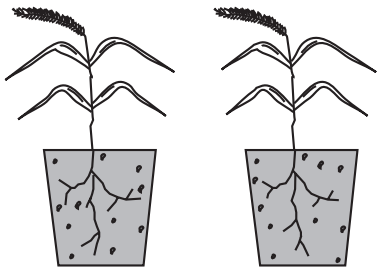
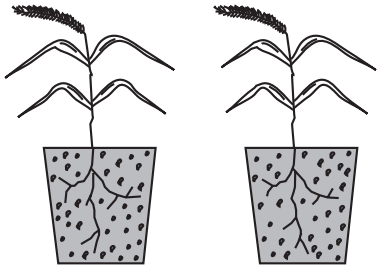
	Trial **A**	Trial **B**
		
First planting	Two cowpea plants	Two sorghum plants
First harvest	Cowpea seeds — Soil kept	Sorghum seeds 100 g Soil kept
		
Second planting	Two sorghum plants	Two sorghum plants
Second harvest	Sorghum seeds 120 g	Sorghum seeds 75 g

Fig. 7

(d) **(i)** State **two** conditions that the student needs to keep the same for all the plants until the end of the experiment.

.....

.....

..... [2]

(ii) Suggest **two** reasons why the second harvest of trial **A** yielded more sorghum than trial **B**.

.....

.....

..... [2]

(iii) Suggest **one** way the student could have made the experiment more reliable.

.....

..... [1]

(e) Planting cowpeas can help increase yields on small farms. This year's planting and yield, for four fields, is shown below.

field A crop maize yield good	**field B** crop maize yield good
field C crop sorghum yield poor	**field D** crop sorghum yield poor

striga seeds found

Fig. 8

The farmer must have some sorghum and maize each year, but wants to plant cowpeas as well.

(i) Complete the field plan in Fig. 9 to show next year's planting and describe the likely yields.

field A crop ..... yield	**field B** crop ..... yield .....
field C crop ..... yield	**field D** crop ..... yield .....

Fig. 9 [3]

(ii) Suggest which crops the farmer should plant in each field over the next three years.

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..... [3]

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Question 4 starts on page 14.

4 Recently large deposits of a chemical, sodium carbonate, have been found in the Makgadikgadi salt pan.

The Government have invested in the large scale extraction of sodium carbonate for export to chemical industries in other parts of the world.

(a) Describe **two** problems that are likely to occur when open cast mining of sodium carbonate takes place.

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..... [2]

(b) How could mining sodium carbonate lead to many new jobs being created in Botswana?

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..... [2]

Look at the diagram of industrial chemical conversions.

Raw material	Process	Product
Calcium carbonate (limestone) →	Great amounts of heat (with ammonia / salt) →	Sodium carbonate
Sodium carbonate (washing soda) →	Great amounts of heat (with sand / limestone) →	Glass
	Great amounts of heat (with slaked lime) →	Sodium hydroxide
Sodium hydroxide →	Cold chemical reaction →	Soaps Rayon (for making clothes)

Fig. 10

Some Government advisers think that statement one is correct, other advisers think that statement two is correct.

STATEMENT ONE

It is more environmentally friendly to mine sodium carbonate than to make it from limestone in the chemical works of other countries.

(c) With reference to the diagram complete the following.

Statement one could be correct because .....

.....

.....

..... [2]

STATEMENT TWO

The problems when mining sodium carbonate and transporting it to other countries are greater than any problems when making sodium carbonate from limestone.

(d) Statement two could be correct because .....

.....

.....

..... [2]

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