Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

5920322842

ENVIRONMENTAL MANAGEMENT **5014/21**

Paper 2 **October/November 2017**

1 hour 30 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.
You may use an HB pencil for any diagrams or graphs.
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.

Study the appropriate source materials before you start to write your answers.
Credit will be given for appropriate selection and use of 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.

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 **13** printed pages and **3** blank pages.

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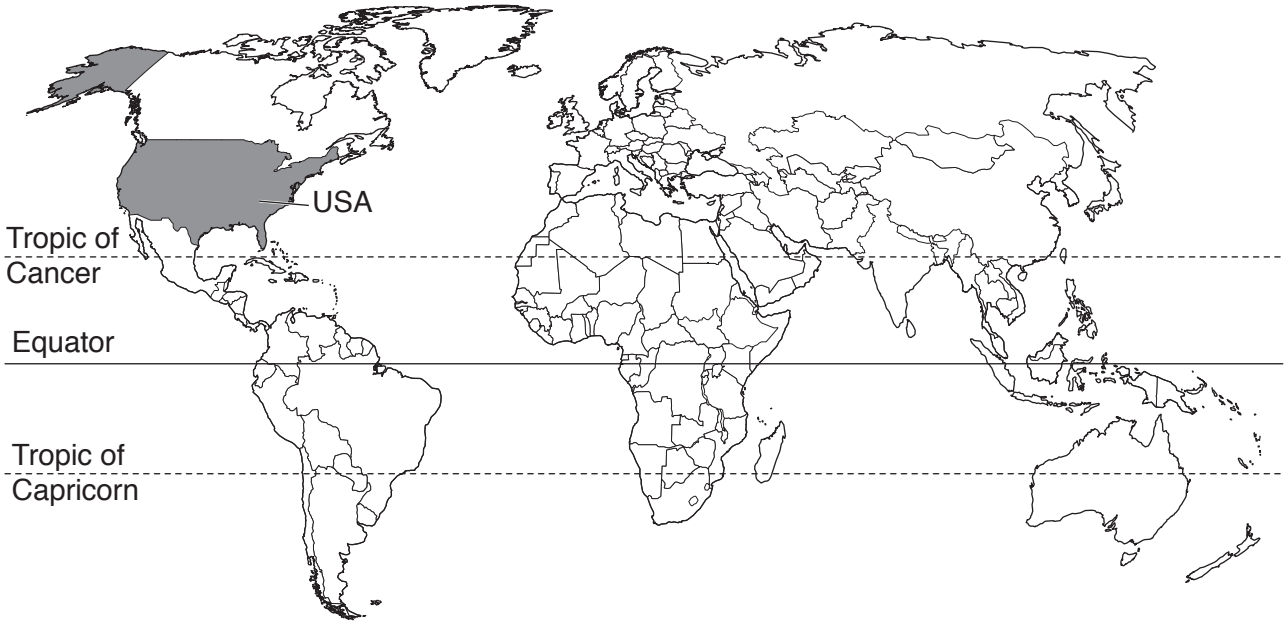
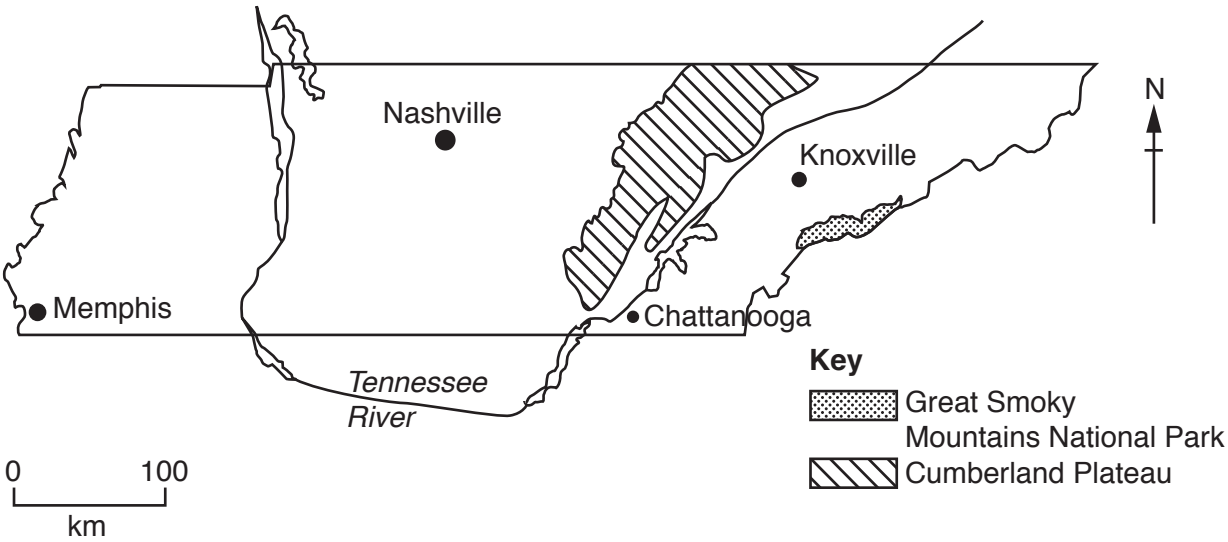
CAMBRIDGE International Examinations

map of the world



map of USA

map of Tennessee



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area of Tennessee: 109 152 km^2

population: 6.5 million (in 2016)

children per woman: 2.1

life expectancy: 76 years

currency: USD

languages: English

main economic activities: agricultural production, electrical power generation, mining, music, tourism and vehicle manufacture

1 The state of Tennessee has large areas of fertile land. The Tennessee River is used to generate electricity. Coal and zinc mining take place in the east of the state. Many tourists visit the Great Smoky Mountains National Park and the state capital, Nashville.

(a) The population of the four largest cities in Tennessee is shown in the table.

city	population
Nashville	659 000
Knoxville	185 000
Chattanooga	177 000
Memphis	656 000
total	.....

(i) Complete the table. [1]

(ii) Calculate the percentage of the total population of Tennessee that live in these four cities.

Show your working.

.....% [2]

(iii) Present the population data of the four largest cities in Tennessee in rank order from highest to lowest by completing the table.

highest

city	population

lowest

[2]

(b) Many farmers grow maize to feed people and animals. Maize plants do not grow well in soils with a shortage of zinc.

A scientist performed a field trial in east Tennessee growing maize. The field was divided into three plots. Plot **A** remained untreated. Plot **B** had a 1% solution of zinc sulfate added and plot **C** had a 2% solution of zinc sulfate added. The maize plants were harvested after 100 days. The table shows the results.

plot	average height of plants / cm	average length of maize cob / cm	yield / tonnes per hectare
A untreated	180	13.7	5.6
B 1% zinc sulfate added	206	14.3	5.9
C 2% zinc sulfate added	218	17.2	6.3

(i) Suggest **two** factors the scientist should have kept the same for each plot.

1 .....

2 .....

[2]

(ii) Explain why the scientist included plot **A** in this field trial.

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..... [2]

(iii) Describe the differences in crop characteristics between plot **A** and plot **B** using information from the table.

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..... [3]

(iv) Calculate the percentage difference in yield between plot **B** and plot **C**.

Show your working.

.....% [2]

(v) Suggest **two** ways the scientist could check the results of this field trial.

1 .....

.....

2 .....

.....
[2]

(c) The scientist recommended that farmers look for the signs of zinc shortage in their crops. Shortage of zinc causes yellow spots on leaves and smaller than average maize plants.

One farmer said

I just look at a few maize plants in one part of a field. If I see any yellow spots I know the crop is short of zinc.

The scientist said to the farmer

This method is not a good way to decide if the crop is short of zinc.

(i) Explain why the method used by the farmer is not a good way to decide if the maize crop is short of zinc.

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..... [2]

(ii) Describe a sampling method the farmer could use in a field to check for a shortage of zinc in the maize crop.

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..... [4]

(iii) The scientist recommended that zinc sulfate can be added to maize fields at the rate of 15.0 kg per hectare to prevent a shortage of zinc. Farmers add zinc sulfate at the same time as fertiliser.

Suggest **two** advantages of adding zinc sulfate at the same time as fertiliser.

1 .....

.....

2 .....

.....
[2]

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2 Tennessee has a green energy policy. Most fuel for vehicles in Tennessee now contains 10% ethanol. Maize is used to produce ethanol. Switchgrass, shown in the photograph, can also be used to produce ethanol and grows well in soils with a shortage of zinc.

Researchers have identified 4.5 million hectares in west Tennessee that have suitable soils for growing switchgrass. A biorefinery has been built and many farmers within 80 km of the refinery have started growing switchgrass. The biorefinery is able to produce nearly a million litres of ethanol per year.

(a) **(i)** Explain why producing ethanol from switchgrass is a sustainable activity.

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..... [2]

(ii) Explain why researchers recommended growing switchgrass no more than 80 km from a biorefinery.

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..... [3]

(iii) Suggest **three** reasons why the researchers and the state authorities do **not** want farmers to grow maize to produce ethanol.

1 .....

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2 .....

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3 .....

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[3]

(b) The researchers compared the production of switchgrass and another crop, hay. Hay is made by cutting and drying grass. Hay is used to feed animals. The table shows the results.

average per hectare	switchgrass	hay
yield / tonnes	14.8	7.4
selling price / USD	968	555
cost of production / USD	770	464
profit / USD	.....	.....

(i) Complete the table. [1]

(ii) Suggest reasons why there may be no advantage to the farmer of growing switchgrass rather than producing hay.

.....

.....

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..... [2]

(c) A survey of 25 farms on the Cumberland Plateau was carried out to find out more about growing switchgrass. The table shows the results.

	percentage response	
question to farmer	yes	no
Will you be growing switchgrass next year?	68	32
Have you been given a five year contract to grow switchgrass?	55	45
Are you expecting to make more profit growing switchgrass rather than producing hay?	70	30

(i) Describe a method that could be used to select the sample of 25 farms.

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..... [2]

(ii) Explain why this survey was carried out by telephone instead of visiting each farm.

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..... [2]

(iii) Suggest **one** way the state authorities could encourage more farmers to grow switchgrass for biofuel.

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..... [1]

(iv) Explain how an increased use of biofuel could help reduce the rise in global temperatures.

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..... [3]

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3 Tennessee has deposits of zinc ore that have been extracted by small scale mines for many years. These small mines have now been abandoned, leaving large waste piles that still release toxic chemicals.

Some fields near an abandoned mine have low crop yields. A scientist took soil samples from these fields and found high concentrations of zinc. High concentrations of zinc are toxic to most bacteria in the soil.

(a) Explain the role of bacteria in maintaining soil fertility.

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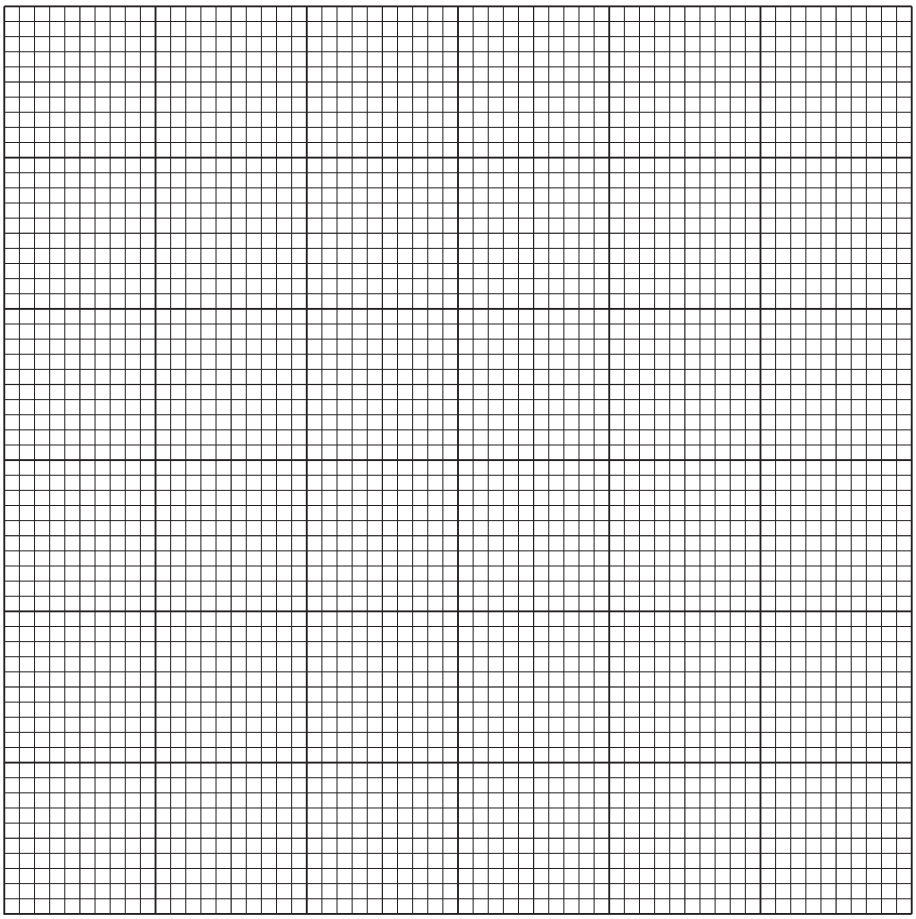
..... [3]

(b) The scientist carried out a laboratory experiment to find out how zinc concentrations affect the growth of maize seedlings. Groups of seedlings were grown for 10 days in nutrient solutions containing different concentrations of zinc. After 10 days the scientist measured the length of all the roots.

The table shows the results.

zinc concentration /parts per million, ppm	average length of maize roots /mm
0	45
20	38
40	31
60	25
80	19
100	11

(i) Plot a line graph of the results on the grid.



[4]

(ii) Describe the trend shown on your graph.

.....

..... [1]

(iii) Determine the average length of maize roots grown in a nutrient solution containing zinc at a concentration of 50 ppm.
Show on your graph how you determined this value.

..... mm [2]

(iv) Suggest why farmers want crop plants that grow long roots.

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..... [3]

(c) Describe how the land can be restored after mining has finished.

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..... [4]

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