UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ENVIRONMENTAL MANAGEMENT **5014/21**

Alternative to Coursework **May/June 2013**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Ruler

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Electronic calculators may be used.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

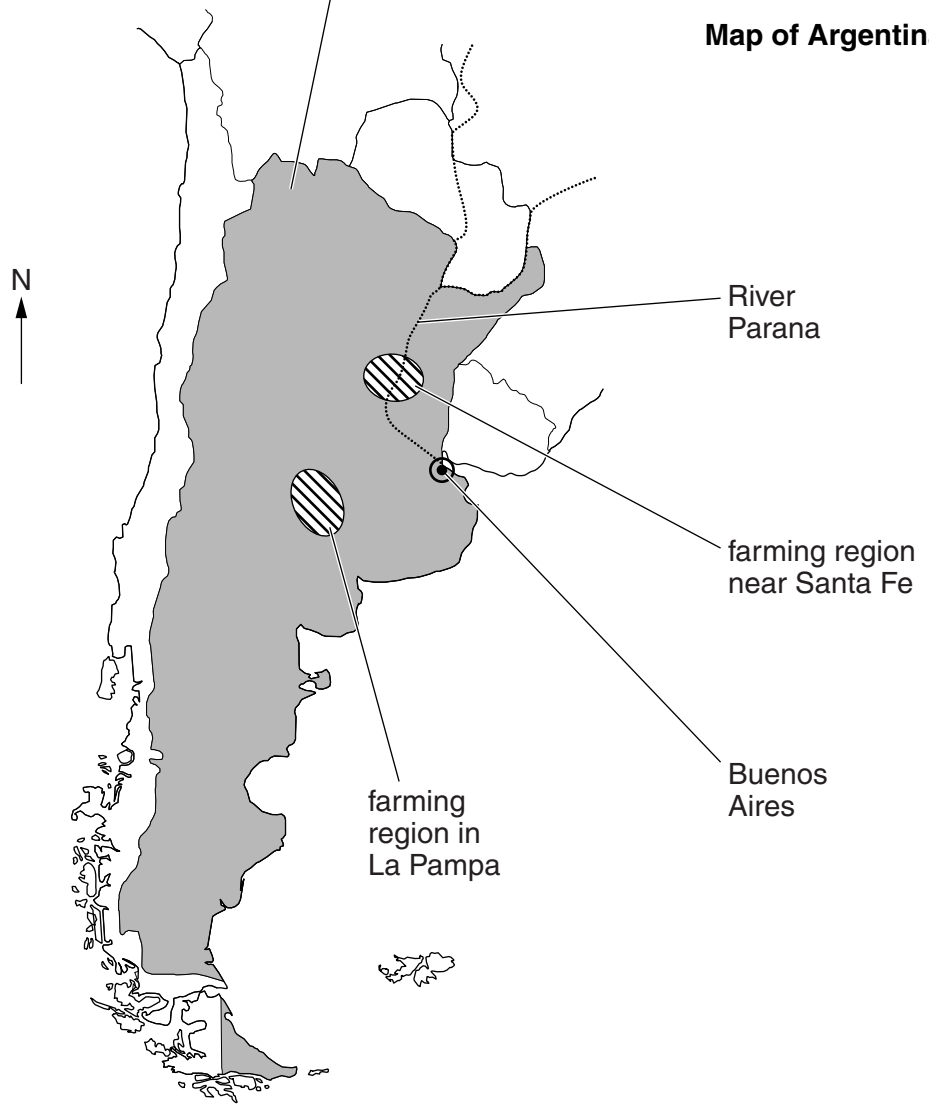
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **20** printed pages.

World map

Map of Argentina



Area of Argentina: 2 800 000 sq km

Population: 43 million

Children per woman: 2.3

Life expectancy: 77 years

Currency: Argentine pesos (4.0 =1US$)

Language: Spanish

Climate: temperate, becomes drier towards the northwest and south east

Terrain: vast grassy plains of the Pampas in the northern half, dry plateau of Patagonia in the south, Andes Mountains in the west

Main exports: soybeans, maize, wheat, beef, manufactured goods and fuels (mainly gas).

Argentina is a country rich in natural resources, with a long history of exporting the agricultural products of the Pampas and a wide industrial base. Approximately 14 million people live in the capital city, Buenos Aires. Argentina has suffered from several economic crises in the last hundred years but the economy has performed well since the world recession of 2009. The rate of inflation remains high.

[Turn over

Answer **all** the questions.

For Examiner's Use

1 **(a)** What do you understand by the term wide industrial base?

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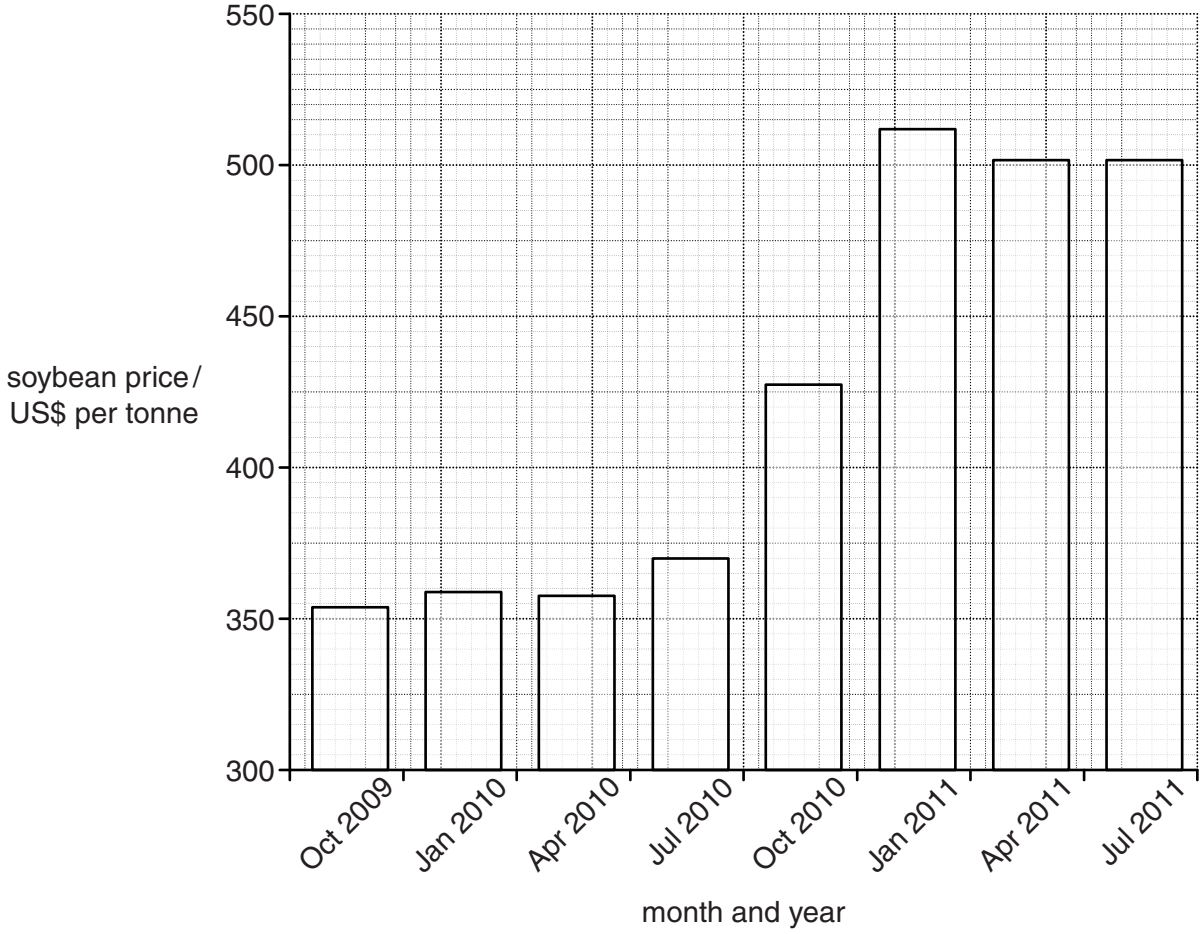
.....[1]

(b) The World demand for soybeans has increased in recent years because they can be used both as an animal feed and as a fuel. The graph shows the world price of soybeans between October 2009 and July 2011.

Graph of world price of soybeans



Describe what is shown by the graph.

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(c) Most of the soybean grown in Argentina is GM (genetically modified). The seeds of soybeans have been genetically modified so a weedkiller 'round up' can be sprayed without damaging the soybean crop. The weedkiller allows large areas of land to be planted with one crop (monoculture).

(i) Explain one advantage to the farmer of using GM soybeans.

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(ii) Suggest **two** possible problems of having large areas of monoculture.

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(iii) Some people think growing GM crops is a risk to the environment. Why do they think this?

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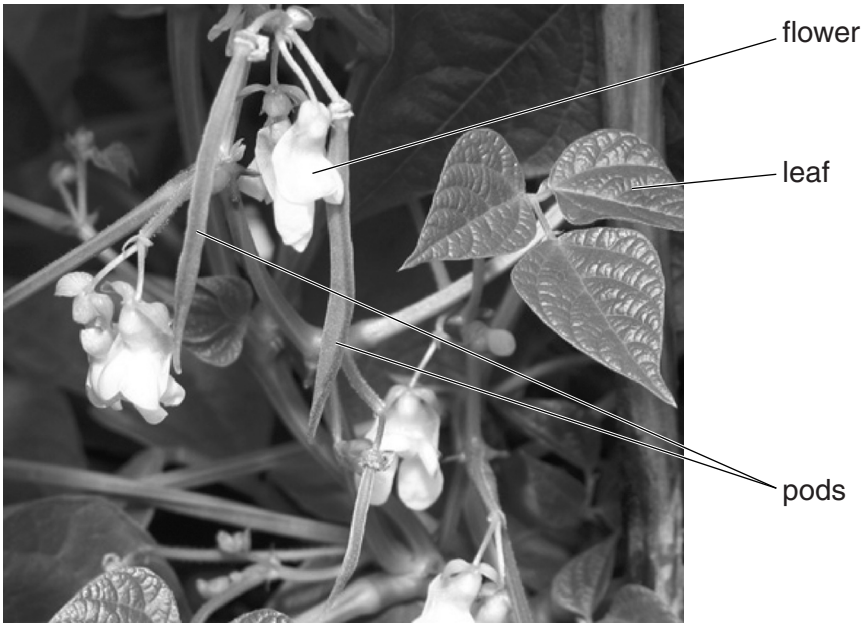
(d) The photograph shows part of a soybean plant.



Soybean plants grow rapidly. A scientist planted soybean seeds in two separate containers using soil that had never been used to grow soybeans. One container had urea added, a fertiliser releasing nitrogen. He took sample plants from each container every 15 days. He found the dry mass of each sample. The results are shown below.

	Dry mass of soybean growth / g m^{-2}	
days from planting	soil without added urea	soil with added urea
15	1.0	1.0
30	2.0	2.0
45	4.2	4.4
60	10.8	10.6
75	12.5	12.4

(i) State **two** factors that the scientist needed to keep the same for both containers.

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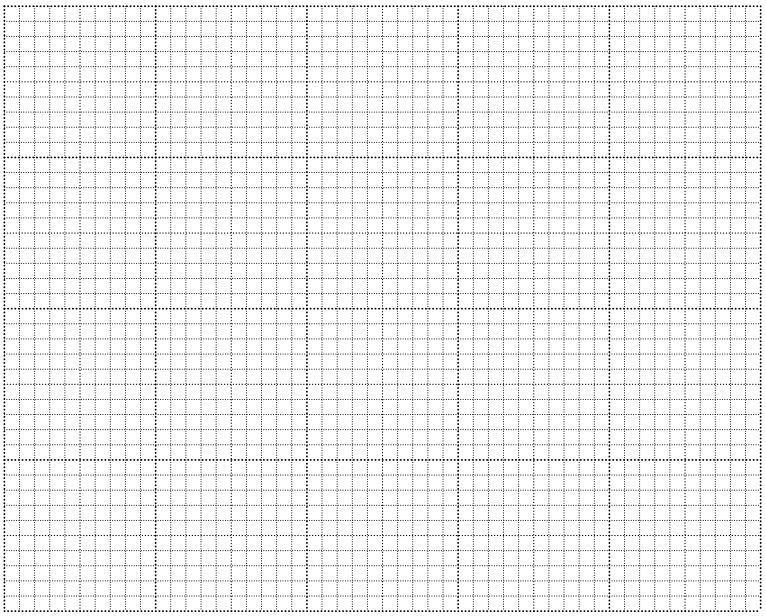
(ii) Plot a graph of the data in the table on page 6.

For Examiner's Use



[4]

(iii) Did the fertiliser make a difference to the growth of soybeans in the two soils? Using information from the graph and table explain your answer.

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(e) The scientist then went to three fields where soybeans were going to be planted. He measured the concentration in the soil of a different nutrient, phosphate. He repeated the measurements after the first harvest in each field. The results are shown below.

For Examiner's Use

field	phosphate concentration before planting / ppm	phosphate concentration after first harvest / ppm
1	1.0	0.8
2	0.9	0.7
3	0.9	0.7

(i) Suggest an explanation for what happened to the phosphate concentration during the growing season.

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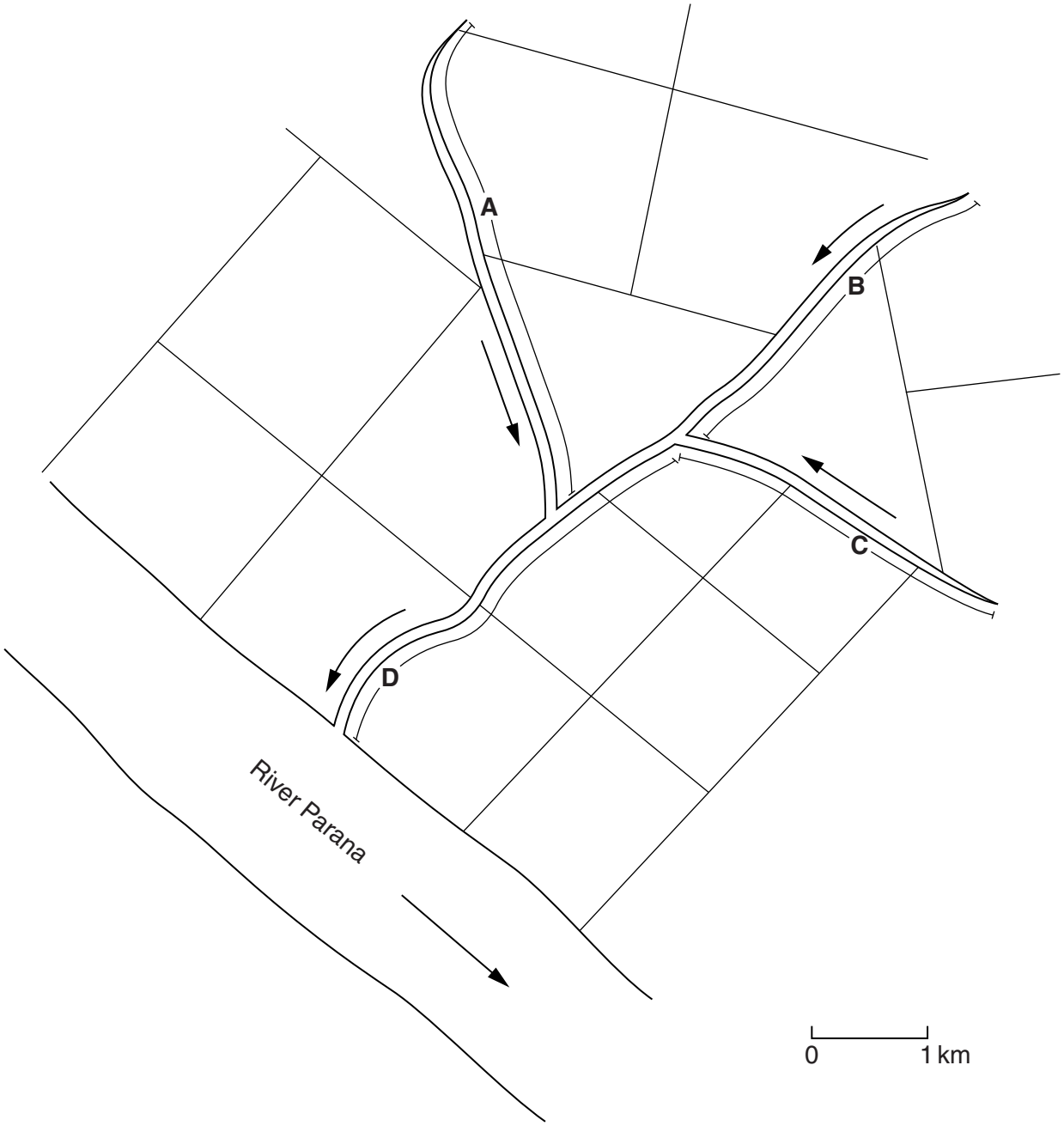
TURN OVER FOR QUESTION 1(e)(ii)

(ii) Farmers often grow soybeans year after year due to high demand. To maintain high crop yields fertilisers are added after the first year of planting soybeans. Another scientist was worried that repeated additions of fertiliser could cause environmental damage to streams and rivers. The scientist looked at a map of areas that had been planted with soybeans for several years and the drainage system as shown in the diagram below.

For Examiner's Use



Key

streams **A**, **B**, **C** and **D**

direction of flow

field

Look at the map.

For Examiner's Use

She studied the map to look at the drainage system. She tried to predict which stream, **A**, **B**, **C** or **D**, would have the **highest** and **lowest** phosphate concentration where soybeans had been planted and fields fertilised. Suggest what she would have predicted.

stream with **highest** phosphate concentration .....

stream with **lowest** phosphate concentration ..... [1]

(iii) Describe the changes to life in the streams that can be caused by high phosphate concentrations.

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(f) A farmer grew GM soybeans in the same field year after year, adding enough fertiliser to replace the nutrients used by the crop each year. The table shows part of the farm records for this field over a period of 6 years.

year	crop	yield / tonnes per hectare
1	soybean	3.8
2	soybean	3.5
3	soybean	3.3
4	soybean	3.3
5	soybean	2.8
6	soybean	2.5

(i) Calculate drop in yield between year one and year six as a percentage of the yield in year one.

Space for working.

.....[1]

(ii) Suggest and explain **one** reason why crop yields fall when a crop is grown year after year in the same field even though the field receives enough fertiliser.

For Examiner's Use

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(iii) Explain how farmers can avoid a drop in yield such as that shown in the table on page 11.

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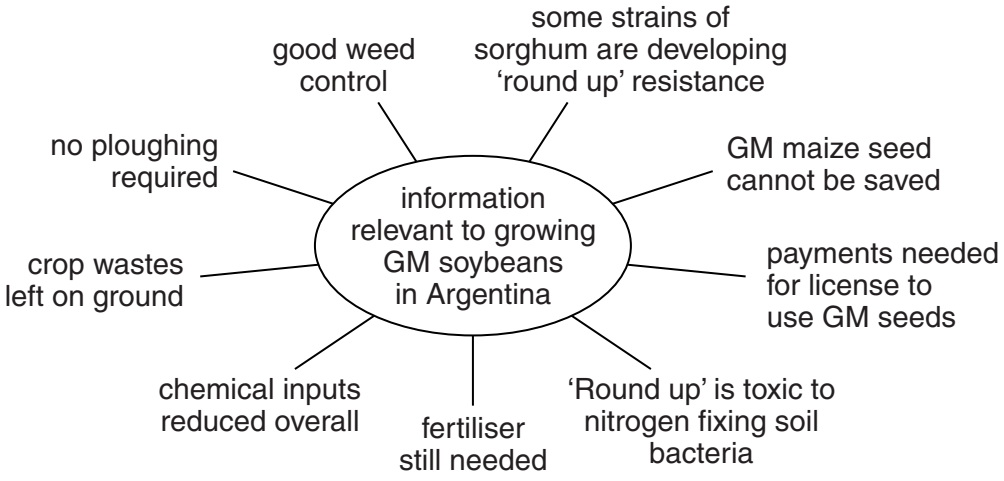
(g) The diagram shows some information which is relevant to GM soybean growing in Argentina.

For Examiner's Use



Growing GM soybean has been profitable for ten years. Would you expect the farming of soybeans to increase or decrease over the next 10–20 years? Explain the reasons for your view.

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[Total: 32]

QUESTION 2 BEGINS ON PAGE 15

2 Some soybeans are processed into biodiesel. All diesel fuel used in vehicles in Argentina has to have 5% biodiesel and 95% diesel refined from crude oil. The vehicle engines do not need to be modified. The carbon emissions from ordinary diesel and biodiesel are similar.

(a) Explain the advantages of using biodiesel.

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(b) Buenos Aires has at least two million vehicles moving in the city at peak travel times. A student noticed that some cars were releasing black smoke from their exhaust systems. The student contacted the city authorities and found that 40% of cars are over ten years old. The student decided to carry out a survey of vehicles causing air pollution. The student used the following method.

1. He selected five observation points **E**, **F**, **G**, **H** and **J**, in different residential (housing areas) districts of the city
2. He observed all traffic from each point for 30 minutes
3. He recorded the number of cars releasing black smoke.
4. All traffic observations were done at the same time of day (9.00–9.30am) from Monday to Friday.

The results are shown below

Residential district

Observation point	**E**	**F**	**G**	**H**	**J**
Number of vehicles releasing black smoke	12	18	52	25	23

(i) Calculate the average number of vehicles releasing black smoke.

Space for working.

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(ii) Suggest reasons for the variation between residential districts.

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(iii) Suggest two ways the survey method could have been improved.

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(c) The student decided to measure the amount of soot (carbon) particles released by vehicles in the same five districts **E**, **F**, **G**, **H** and **J**. The student used the following method.

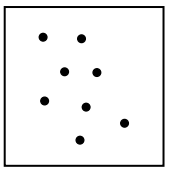
1. Prepare 15 clear plastic boxes by covering the bottom with sticky jelly.
2. Immediately cover the box with a tightly fitting lid.
3. Place three boxes at each observation point, two metres above the ground.
4. Remove the lids for 24 hours.
5. Collect and seal the boxes.
6. Count the soot particles in each box.

The results for October are shown below. For observation point **J** the boxes with the soot particles in are shown below the table.

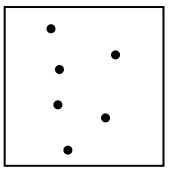
	number of soot particles at each observation point in October				
sample	**E**	**F**	**G**	**H**	**J**
1	11	6	7	14	.....
2	8	10	9	11	.....
3	8	8	5	14	.....
average number of soot particles	9	8	7	13	.....

Boxes for observation point **J**

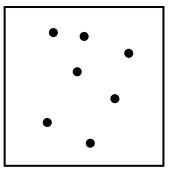
sample **1**



sample **2**



sample **3**



(i) Complete the table for observation point **J**.

Space for working.

Put your answer in the space in the table on page 16 [1]

(ii) Suggest one piece of information the student should have included in their method so it could be repeated reliably.

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(iii) Which district, **E**, **F**, **G**, **H** or **J**, does this method show is likely to be most polluted?

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(iv) The survey described in question **2(b)** (page 15) found that district **G** was likely to be the most polluted. Suggest **one** possible explanation for the different findings of the two methods.

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(d) The survey carried out in October was repeated six months later in April in the same five districts **E**, **F**, **G**, **H** and **J**.

The results for April are shown below.

Number of soot particles at each observation point in April

	E	**F**	**G**	**H**	**J**
average number of particles	11	9	8	15	9

(i) The student compared these results with the results from the October survey.

Suggest a conclusion.

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(ii) The student found a secondary source of average climatic information for Buenos Aires.

	average monthly temperature and wind speeds for Buenos Aires											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
average air temperature / °C	26	25	23	20	16	13	12	13	15	19	22	25
average wind speed / knots	9	9	9	8	8	8	9	9	11	10	10	9
percentage of days with winds greater than 11–15 knots	35	27	28	20	23	24	26	28	40	39	36	31

Describe how the data in the table helps to explain your conclusion in part **(i)**.

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(iii) A newspaper said that air pollution in Buenos Aires was very high in July. Suggest a possible reason for this.

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(e) The same newspaper did a survey of farmers living in an area of La Pampa and of people living in Buenos Aires. The question asked was; Are you in favour of the use of biodiesel in vehicles in Argentina?

percentage of people saying:	yes	no	not sure
People living in Buenos Aires	65	20	15
Farmers in La Pampa	90	5	5

(i) Suggest reasons for the differences between the views of city people and farmers.

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(ii) The student wanted to find out more about people's views and their knowledge of alternative renewable energy sources. The student started writing a questionnaire.

1. What age are you? .....
2. Are you male or female? Male ..... Female .....
3. Do you own a car? Yes ..... No .....
4.
5.
6.

Complete the questionnaire with three more questions designed to find out more people's views and knowledge of other renewable energy sources. [4]

(f) Investing in renewable sources of energy is often very expensive. What arguments would you use to persuade people living in Argentina that paying higher taxes to pay for investment in renewable sources is a good idea?

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[Total: 28]