Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

ENVIRONMENTAL SCIENCE 8290/02

Paper 2

May/June 2004

1 hour 45 minutes

Additional Materials: Answer Paper

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, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A – Core
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B – Options
Answer **all** questions from **one** of the three Options.
For your chosen Option, write your answers to the first five questions in the spaces provided on the question paper. Answer the final question on separate answer paper.

At the end of the examination,
1. fasten all separate answer paper securely to the question paper;
2. enter the question numbers from your chosen Option in the grid opposite.

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	
Section A	
1	
2	
3	
Section B	
Total	

This document consists of **27** printed pages and **1** blank page.

Section A

Answer **all** the questions.

1 **(a)** When 1 kg samples of soil and water are heated by a given quantity of energy, the soil reaches a higher temperature than the water. The water cools down more slowly than the soil.

How does this affect the variation in temperatures over land and sea during a 24 hour period?

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.....[3]

(b) The Aral Sea is one of the Earth's largest lakes. Due to water abstraction, it has decreased in size to less than half of its former area in thirty years. Reports suggest that the local climate has changed in this time, with hotter, drier summers and longer, colder winters.

Explain how the change to the lake could have caused the change in the local climate.

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.....[5]

2 A hectare of land receives 38 000 GJ of energy per year. The land is used for growing crops between spring and autumn.

(a) What is the source of the energy received by the land?

.....[1]

(b) Not all the 38 000 GJ falls on the crops.

State **one** reason for this.

.....

.....[1]

(c) Of the energy that does fall on the crops, only part is used for photosynthesis.

Why is this?

.....

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.....[3]

(d) Photosynthesis increases the biomass of the crops but the energy value of the crop biomass is less than the energy used for photosynthesis.

Why is this?

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.....[2]

For Examiner's Use

3 Fig. 3.1 shows population pyramids for two different countries, **A** and **B**.

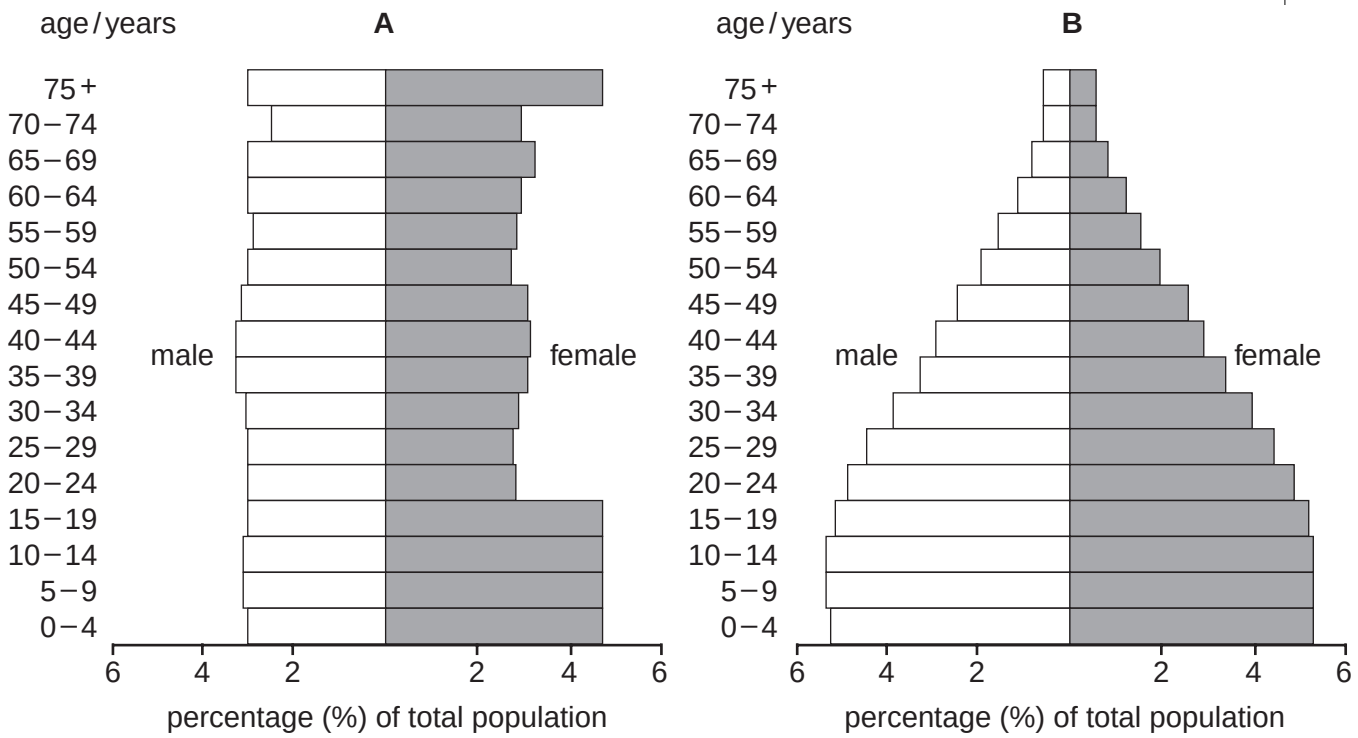

Fig. 3.1

(a) Describe the differences between the two population pyramids.

.....

.....

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.....

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.....

.....[4]

(b) (i) State which country is likely to be the more developed.

.....[1]

(ii) Explain why the population pyramid of a developing country will gradually change to that of a developed country.

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.....[5]

For Examiner's Use

Section B

Answer **all** the questions from **one** of the three Options.

OPTION 1 - THE EXPLOITATION OF ENERGY RESOURCES

Answer questions 4, 5, 6, 7 and 8 in the spaces provided.

4 **(a)** What is meant by the term *fossil fuel*?

.....

.....

.....[2]

(b) List two examples of fossil fuels.

1. .....

2. .....[2]

(c) Describe the formation of **one** of the examples that you have given.

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.....[4]

5 Cities are experiencing increasing problems from pollution caused by cars and other vehicles.

Explain why each of the following techniques could be important in reducing these problems.

- Car radiators coated in a catalyst that breaks down ozone.

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- Paving stones coated in titanium dioxide. Titanium dioxide acts as a photocatalyst, speeding up the breakdown of water vapour by UV radiation to produce hydroxyl radicals.

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- Modified cement, based on magnesium carbonate rather than calcium carbonate. Magnesium carbonate absorbs CO_2 more efficiently.

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.....[8]

6 **(a)** Outline the differences between *nuclear fission* and *nuclear fusion*.

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.....[4]

(b) Explain why fission rather than fusion is used in generating electricity.

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.....[2]

(c) State two advantages and two disadvantages of generating electricity from nuclear power.

advantage 1 .....

.....

advantage 2 .....

.....

disadvantage 1 .....

.....

disadvantage 2 .....

.....[4]

7 **(a)** List four factors that must be considered when selecting a site for a wind farm.

1. .....

2. .....

3. .....

4. .....[4]

(b) State two advantages of generating electricity by wind power.

1. .....

2. .....[2]

(c) Suggest **one** reason why off-shore wind farms may have an advantage over those which are land-based.

.....

.....[1]

8 Fig. 8.1 shows how electricity can be generated using water stored behind a dam.

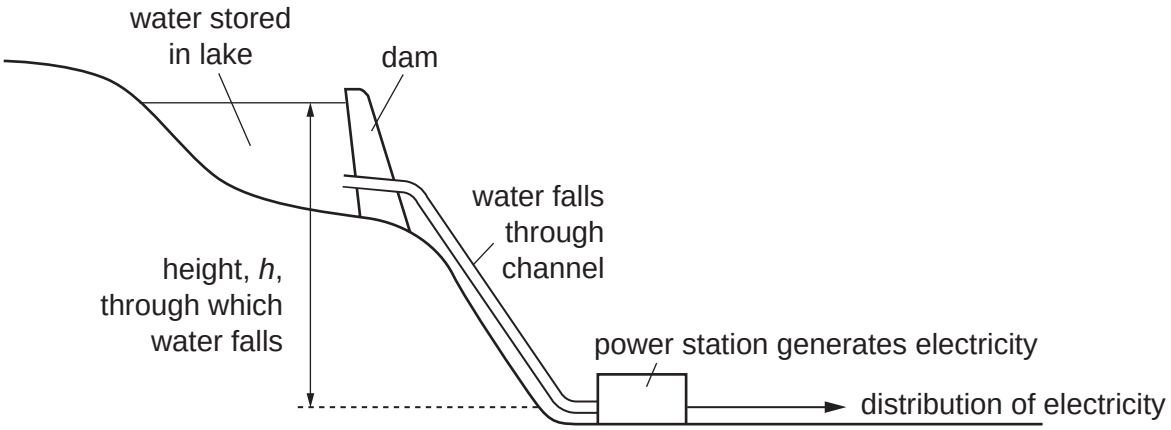

Fig. 8.1

(a) (i) What are the units used for potential energy?

.....[1]

(ii) State the formula used to calculate the potential energy transferred by a mass, *m*, of water moving down from the surface of the lake to the power station.

.....[1]

(iii) The conversion of potential energy, stored in the dam, into electrical energy is not 100% efficient.

Suggest two reasons for this.

1. .....

2. .....[2]

(b) List three problems associated with building dams for electricity generation.

1. .....

2. .....

3. .....[3]

Answer this question on the separate answer paper provided.

9 **(a)** Outline how tides are produced. [5]

(b) **(i)** Describe the way in which barrages can harness tidal power to generate electricity. [5]

(ii) Outline the advantages and disadvantages of generating electricity this way. [5]

[Turn over

OPTION 2 - THE MANAGEMENT OF NON-BIOLOGICAL RESOURCES

Answer questions 10, 11, 12, 13 and 14 in the spaces provided.

10 Fig. 10.1 shows the stages in the treatment of water to make it fit for human consumption.

The numbers refer to the number of *E. coli* bacteria found in 250 cm^3 of water.

This is used as a measure of water purity.

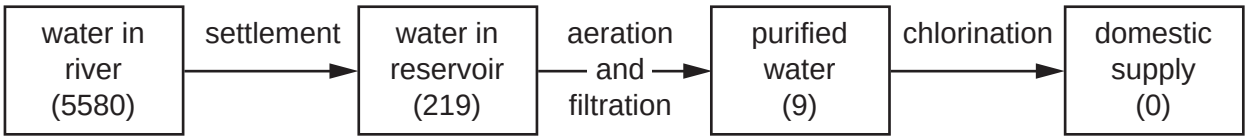

Fig. 10.1

(a) Calculate the percentage (%) of *E. coli* removed during settlement.

Show your working.

.....% [3]

(b) How does filtration remove bacteria and other impurities?

.....

.....

.....[2]

(c) Ozone or ultraviolet radiation can be used in place of chlorine in the final stage of disinfecting water.

Suggest **one** advantage of these methods over chlorination.

.....

.....[1]

11 Lake Baikal is a large lake surrounded by mountains and conifer forest. Logging companies have cleared large areas of forest for timber production. Soil erosion and landslides have become a problem for people living in the region. As a result of logging, large amounts of timber and plant debris have been carried into the lake, where they have rotted. The number and variety of aquatic organisms in the lake have decreased sharply during this time.

(a) Explain why soil erosion and landslides have been brought about by clearing the forest.

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.....[4]

(b) **(i)** What is meant by the term *eutrophication*?

.....

.....

.....[2]

(ii) Explain why the number and variety of aquatic organisms in the lake have decreased sharply during this time.

.....

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.....[4]

12 **(a)** What are the typical climate and vegetation where ferralsol (laterite) soil is found?

climate .....

vegetation .....[2]

(b) Ferralsol (laterite) soils are generally infertile. Explain the reasons for this.

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.....[4]

(c) State two **other** features of a ferralsol (laterite) soil.

1. .....

2. .....[2]

13 Landfill is a common way of disposing of waste.

(a) Two substances produced by landfill sites are leachate and landfill gas.

(i) What is meant by the term *leachate*?

.....

.....

.....[2]

(ii) What are the problems caused by leachate and landfill gas?

leachate .....

.....

.....

.....

landfill gas .....

.....

.....

.....[4]

(iii) How can these problems be overcome?

.....

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.....[3]

(b) State **one** other problem of landfill as a means of waste disposal.

.....

.....[1]

14 Fig. 14.1 shows the energy used in producing a returnable, re-fillable glass bottle and a non-returnable bottle.

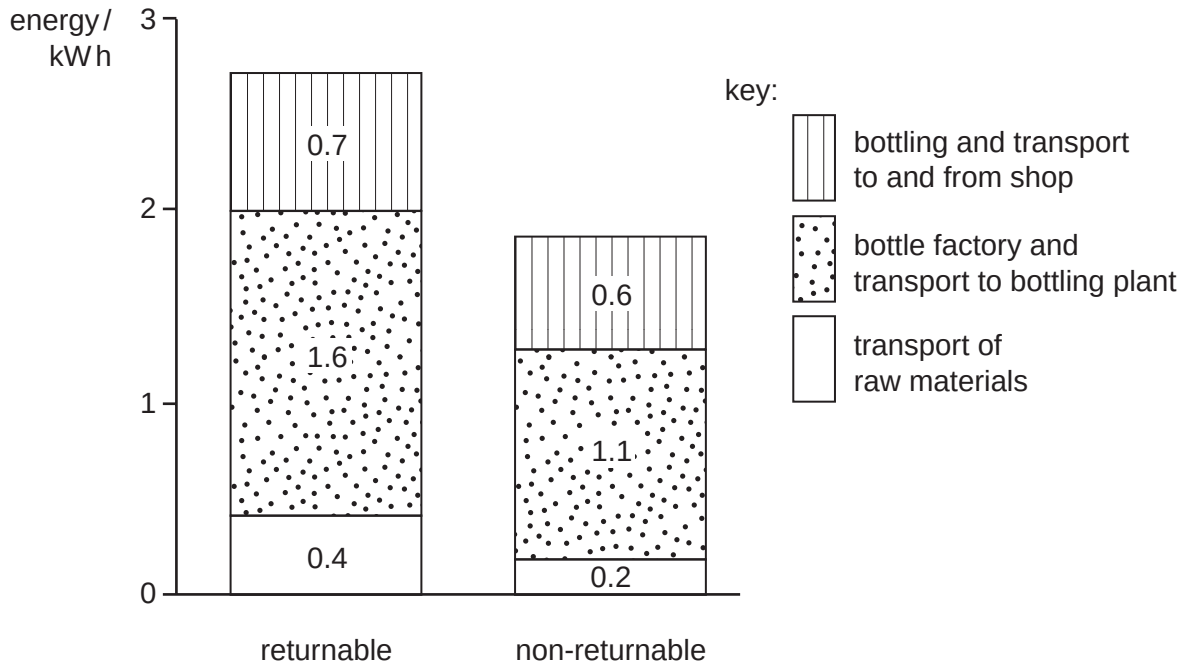


Fig. 14.1

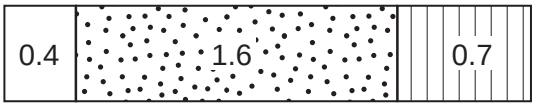
Returnable bottles, which will be re-filled and used again many times, are heavier than non-returnable bottles, so take more energy to produce.

(a) How much more energy is required to produce, fill and distribute a returnable bottle?

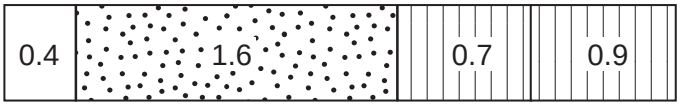
Show your working.

.....[2]

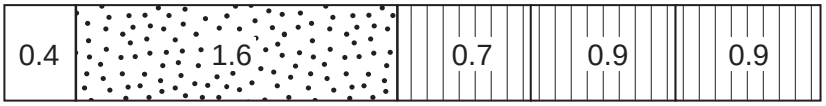
(b) Fig. 14.2 shows the energy needed for re-use of returnable bottles.



total energy used for first use;
1 trip = 2.7kW h



total energy used after first re-use;
2 trips = 3.6kW h



total energy used after second re-use; 3 trips = 4.5kW h

Figures represent kilowatt hours (kW h)

Fig. 14.2

(i) Which energy requirements are used only for the first production and use?

.....[1]

(ii) Show that a returnable bottle is saving energy when it is used twice.

.....[2]

(iii) Re-use of a bottle needs 0.9 kW h of energy for re-filling and transport to and from the shop.

Suggest why this has risen from 0.7 kW h needed for the first use.

.....

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.....[1]

Answer this question on the separate answer paper provided.

15 (a) (i) Outline the sources of oil pollution in seas and oceans. [4]

(ii) Describe the damage caused by this form of pollution. [5]

(b) Describe the actions that can be taken to combat oil pollution in seas and oceans, when it occurs. [6]

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OPTION 3 STARTS ON PAGE 20

[Turn over

OPTION 3 - THE CONSERVATION OF BIOLOGICAL RESOURCES

Answer questions16, 17, 18, 19 and 20 in the spaces provided.

16 **(a)** Explain what is meant by the term *natural selection*.

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.....[5]

(b) A wind-pollinated grass species can exist in a copper-tolerant form. Grass seed was collected from plants growing in the vicinity of a copper mine. The copper content of the soil increases closer to the mine. Fig. 16.1 shows the collection points.

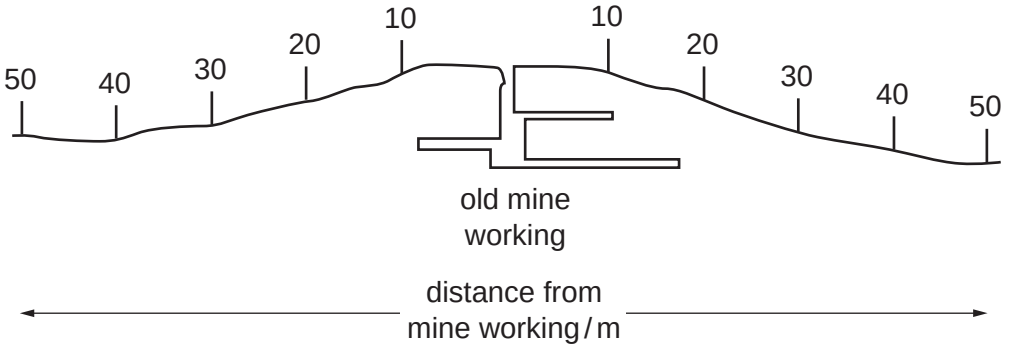

Fig. 16.1

Table 16.1 shows the results of growing the seed collected from the different points. The growing medium contained all the nutrients needed. Batch **A** was watered with a solution containing copper ions. Batch **B** was watered with distilled water. There were twenty seedlings in each batch from each collection point.

Table 16.1

distance from mine working that seeds were collected/m	batch **A**		batch **B**	
	number of seedlings that grew	mean height of seedlings/cm	number of seedlings that grew	mean height of seedlings/cm
10	20	3.9	20	4.0
20	20	3.8	20	4.1
30	12	4.0	20	4.9
40	4	3.7	20	4.8
50	2	3.8	20	4.9

How did the seedlings in batch **A** and in batch **B** differ in terms of

(i) the number that grew,

.....

.....

.....[1]

(ii) the mean height?

.....

.....

.....[1]

(iii) Explain the results in terms of natural selection.

.....

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.....

.....

.....[3]

17 **(a)** The more developed a country becomes, the greater the demand for increased agricultural production.

State **one** reason for this.

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.....[1]

(b) Fig. 17.1 shows some of the impacts of intensified agricultural production.

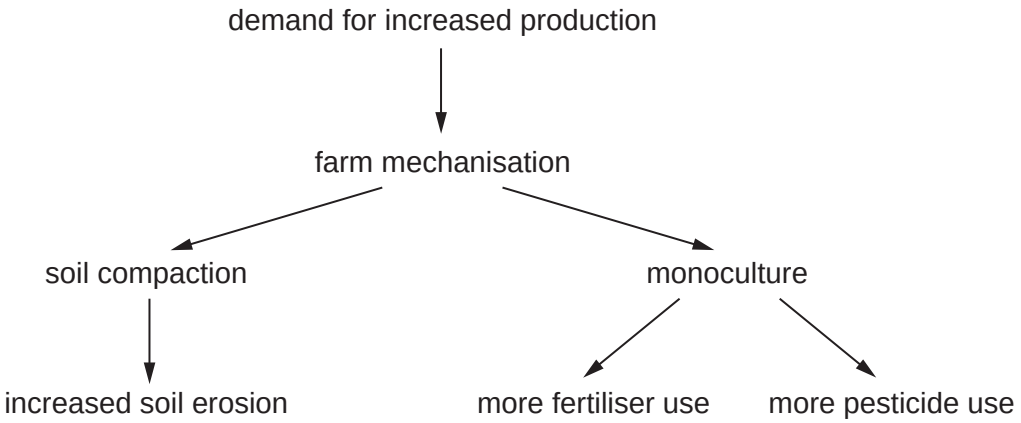

Fig. 17.1

(i) What is meant by the term *monoculture*?

.....

.....[1]

(ii) Why does monoculture result in increased fertiliser use?

.....

.....[1]

(iii) State **one** problem that may arise from increased pesticide use.

.....

.....[1]

(iv) How does farm mechanisation bring about soil compaction?

.....

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.....[2]

(v) Outline two techniques that can be used by farmers to reduce soil erosion.

1. .....

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2. .....

.....[2]

18 Shifting cultivation has been traditionally practised in tropical rainforest. Trees and vegetation in a small area are cut and burned. The ash is used to enrich the soil and crops are grown on the cleared land for a few years. As soil fertility decreases the farmers move on to clear another area. Meanwhile the original area is left for many years to regenerate. In recent years people have moved from cities to practise shifting cultivation, increasing the population in the forest areas. Fig. 18.1 shows the effect of shifting cultivation at low and high population densities.

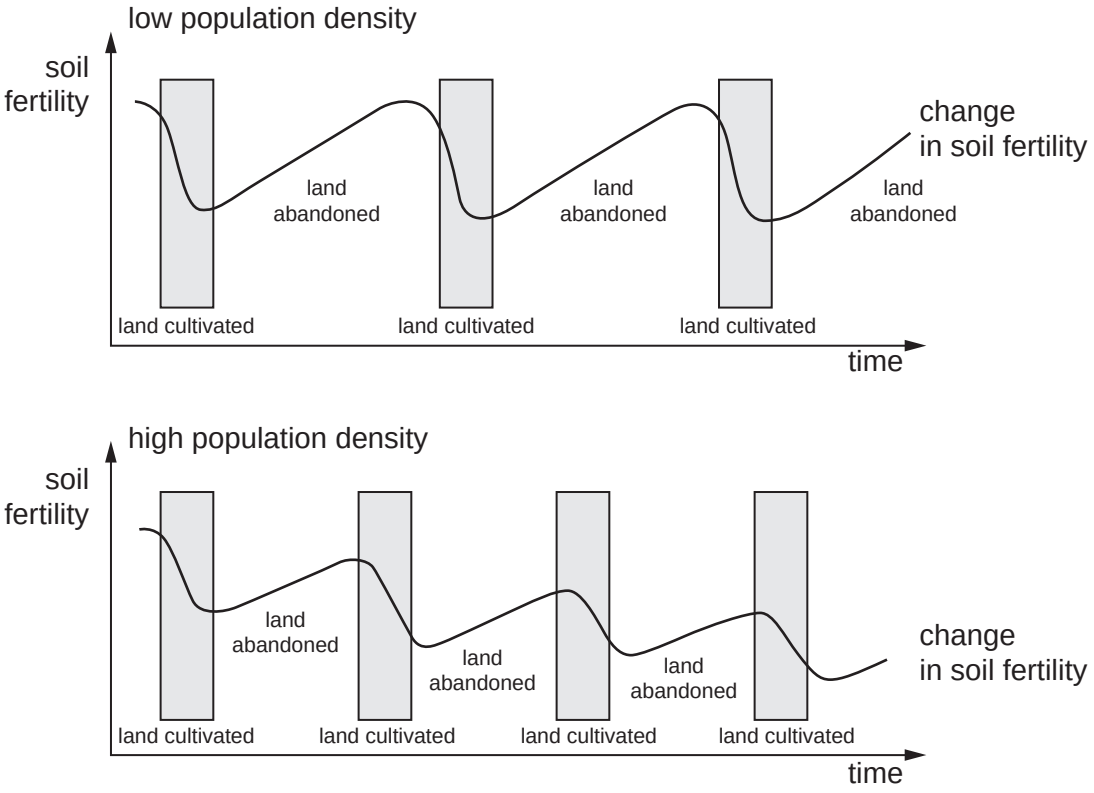

Fig. 18.1

(a) What does Fig. 18.1 suggest about the effect of increased population density on land use?

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.....

.....[2]

(b) What is the effect of higher population density on soil fertility?

.....[1]

(c) Explain the reasons for the change in soil fertility.

.....

.....

.....[2]

19 Each year, 60 to 80 million tonnes of fish are caught by commercial fishing boats. Overfishing is having a severe effect on stocks of many of the fish species caught for food.

(a) (i) What is meant by the term *overfishing*?

.....

.....[1]

(ii) State two signs that indicate overfishing is happening.

1. .....

2. .....[2]

(b) Fig 19.1 shows drift nets and bottom trawls, two techniques used by fishing fleets.

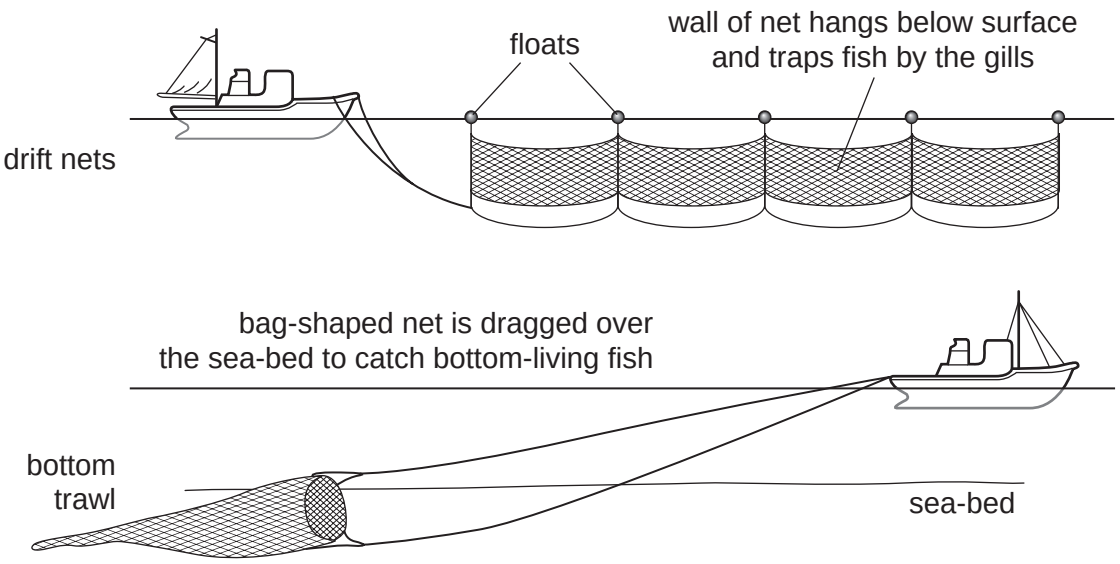

Fig. 19.1

(i) How could regulations controlling the mesh size of drift nets help to regulate fish stocks and control overfishing?

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.....

.....[2]

(ii) Suggest ways in which bottom trawls can damage the marine ecosystem.

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.....

.....[3]

20 **(a)** State three reasons why ranching can be a more effective use of animal resources than hunting.

1. .....

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2. .....

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3. .....

.....[3]

(b) A well-managed herd should not exceed the carrying capacity of the land on which it grazes.

(i) What is meant by the term *carrying capacity*?

.....

.....[1]

(ii) State two effects of allowing a herd to exceed the carrying capacity of land.

1. .....

2. .....[2]

(c) In the Sahel (an arid area of sub-Saharan Africa) herds of sheep and goats have traditionally been moved from place to place to make best use of limited grazing. In recent years, the population in this area has increased and become more settled, leading to larger herds that graze in one area all the time.

Explain how grazing larger herds, in the same place all the time, will affect the productivity of the animals.

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.....[3]

Answer this question on the separate answer paper provided.

21 **(a)** Explain why both temperate and tropical forests are an important resource on the Earth. [5]

(b) **(i)** Describe the problems associated with deforestation. [6]

(ii) Outline ways in which forestry can be sustainable. [4]