Centre Number	Candidate Number	Name

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

ENVIRONMENTAL SCIENCE 8290/02

Paper 2

May/June 2003

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 **24** printed pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate
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Section A

Answer **all** the questions.

Write your answers in the spaces provided.

1 Fig. 1.1 shows two thermometers.

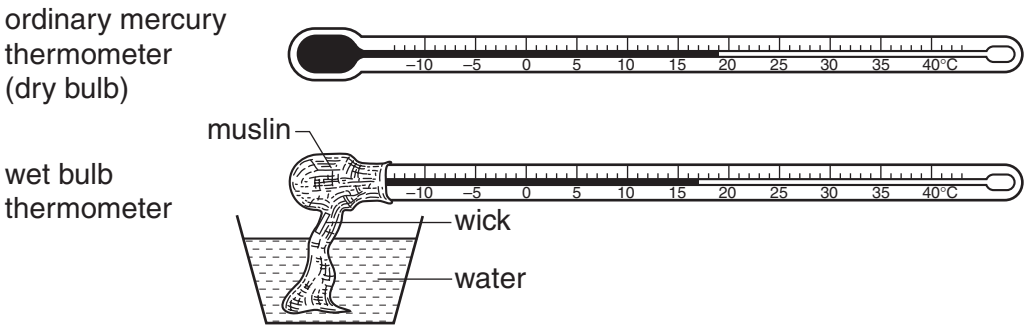

Fig 1.1

(a) The *wet bulb* thermometer generally records a lower temperature than the *dry bulb* thermometer under the same conditions.

Explain why this happens.

.....

.....

.....[2]

(b) Suggest why the difference in the two temperatures recorded can be used to measure relative humidity. (Calculation not required)

.....

.....

.....

.....[3]

2 Fig. 2.1 shows an experimental housing design, tested in a country in the **southern** hemisphere, where daytime summer temperatures can be very high but winter temperatures are cool.

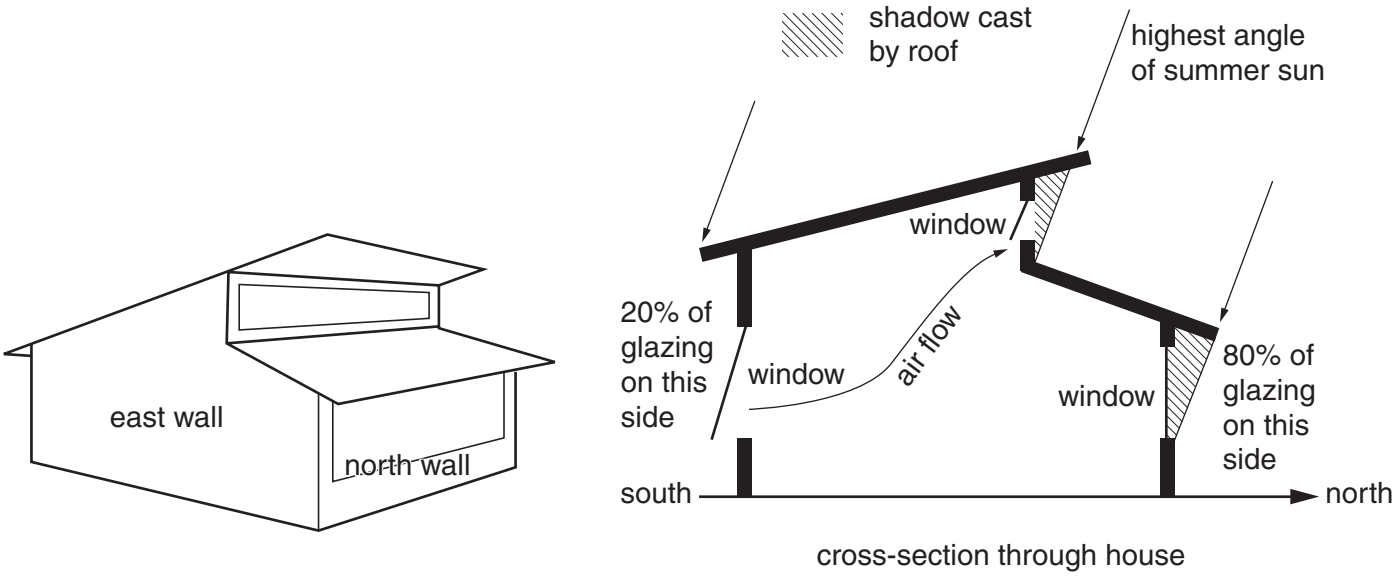

Fig. 2.1

(a) Explain why the arrangement of the windows maximises the amount of light entering in winter but helps to keep the house cool in summer.

.....

.....

.....

.....[3]

(b) The house is oriented on an east-west axis. The sun rises in the east and sets in the west. There are no windows in the east or west walls of the house. How can this help to prevent overheating in summer?

.....

.....

.....[2]

(c) Explain how the opening of the high-level windows on summer nights can help to control high temperatures in the house. Use your knowledge of the way in which currents develop when air or water are heated.

.....

.....

.....

.....[4]

[Turn over

3 **(a)** An example of a simple food chain is:

tree ⟶ insect ⟶ bird ⟶ bird of prey

(i) Sketch the shape of a pyramid of numbers for this food chain.

[1]

(ii) Sketch a pyramid of energy for the same food chain.

[1]

(iii) Explain the difference in the shapes of the two pyramids.

.....

.....

.....

.....[3]

(b) Fig. 3.1 shows age-distribution profiles for a developed and a developing country for 1990 and the predicted profiles for 2025.

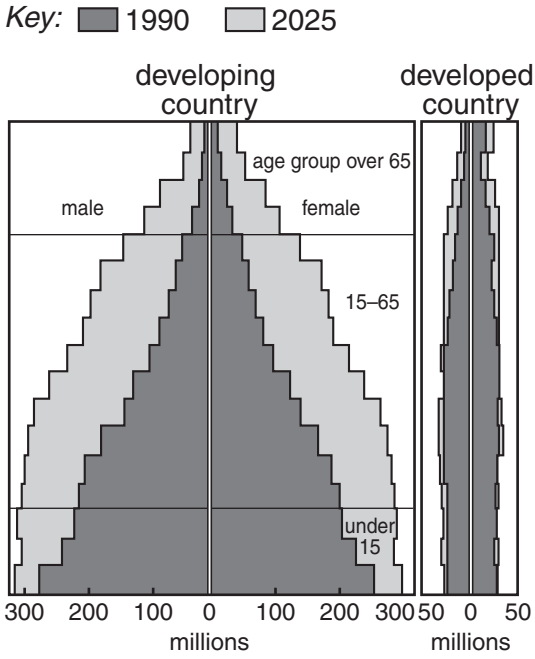

Fig. 3.1

(i) Explain the differences between the 1990 profiles for the developed and the developing country.

.....

.....

.....

.....[3]

(ii) Suggest reasons for the differences in the projected changes in the two profiles for the developed and the developing country.

.....

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.....

.....[3]

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)** State the *First Law of Thermodynamics*.

.....

.....[2]

Power is the rate of energy expenditure and can be expressed by the equation

$$P = E \div t$$

where P is power, E is energy and t is time in seconds.

(b) What are the units of energy? .....[1]

(c) An electric lamp has a power rating of 60 W and is switched on for 5 minutes. Calculate how much electrical energy will be needed to keep the lamp lit for this time.

(Show your working.)

electrical energy needed .....[2]

(d) Explain why the light energy produced is less than the electrical energy put in.

.....

.....

.....[2]

5 **(a)** Explain what is meant by *fossil fuel.*

.....

.....

.....

.....

.....[4]

(b) **(i)** Outline the way in which burning fossil fuels can contribute to *acid rain*.

.....

.....

.....

.....[3]

(ii) List three types of environmental damage caused by acid rain.

1. .....

2. .....

3. .....[3]

[Turn over

6 **(a)** Nuclear energy can be released by the processes of *fission* and *fusion*.

Distinguish between fission and fusion.

fission .....

.....

.....

fusion .....

.....

.....[4]

(b) State two advantages of generating power from sources of nuclear energy.

1. .....

.....

2. .....

.....[2]

(c) There is a proposal to build a plant for reprocessing spent nuclear fuel, but many objections are raised by the local community. Suggest two objections that may be raised to the building of such a plant.

1. .....

.....

2. .....

.....[2]

7 Fig 7.1 shows a large dam used for generating electricity.

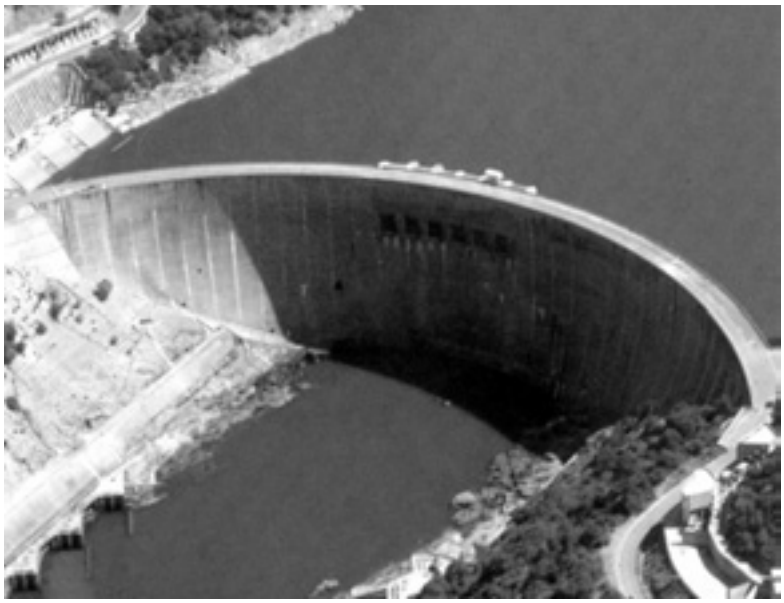

Fig. 7.1

(a) The energy, *E*, generated by water from such a dam can be expressed by the equation

$$E = mgh.$$

Explain how this equation can be applied to the generation of electricity from the dam.

.....

.....

.....

.....

.....[4]

(b) Outline the way in which tidal barrages can be used to generate electricity.

.....

.....

.....

.....[2]

8 **(a)** In recent years, some of the world's largest oil companies have made large investments in developing wind power and solar power technologies.

Suggest a reason for these investments.

.....

.....[1]

(b) An objection raised to wind turbines, used to generate electricity, is the level of noise that they produce. Fig. 8.1 compares the level of noise from a wind turbine with other sounds.

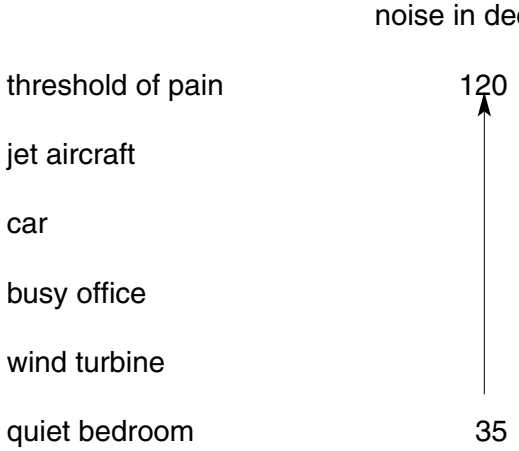

Fig. 8.1

(i) Suggest **one** reason why the noise produced by wind turbines is considered to be a problem.

.....

.....[1]

(ii) Apart from noise, state **one** other disadvantage and **one** advantage of wind power.

disadvantage .....

.....

advantage .....

.....[2]

(c) (i) What is *geothermal energy*?

.....

.....

.....[2]

(ii) Outline **one** way in which power can be generated from geothermal energy.
(Illustrate your answer with a diagram if this makes it clearer.)

.....

.....

.....

.....

[3]

Answer this question on the separate answer paper provided.

9 (a) Describe the way in which photochemical smog forms and explain the problems that it causes. [7]

(b) Describe the ways in which the causes of photochemical smog can be reduced. [8]

For Examiner's Use

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 effects of forest on the fate of rainfall on slopes.

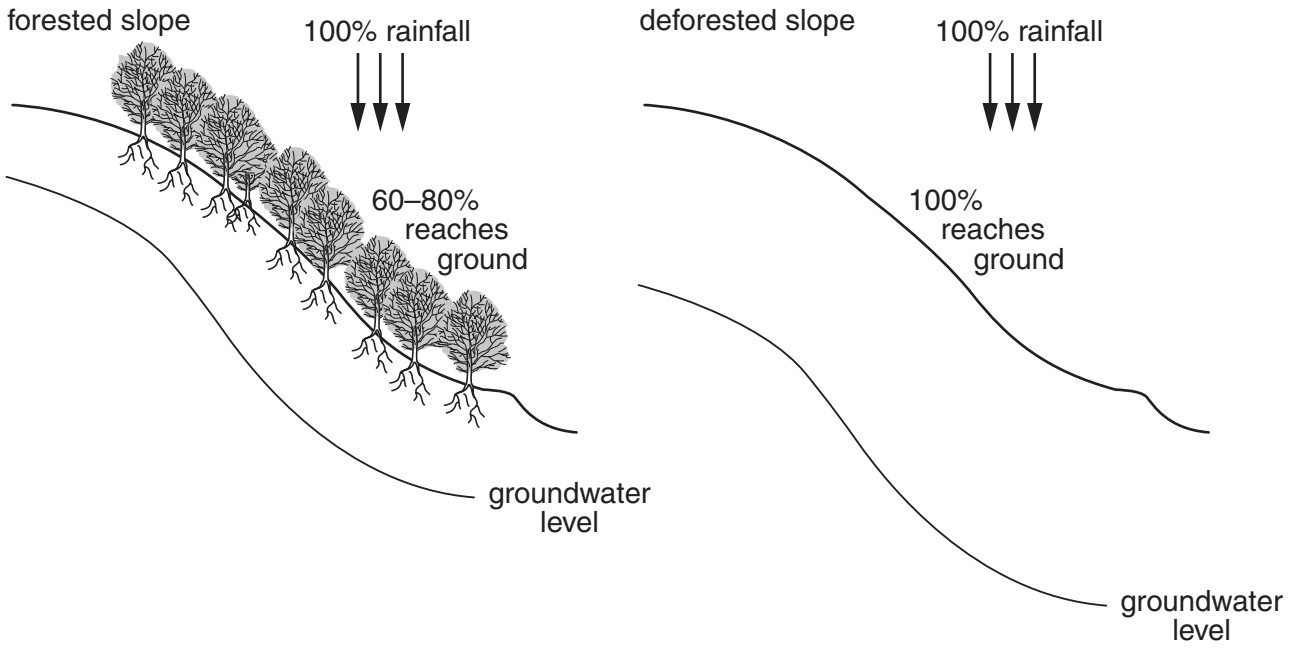

Fig. 10.1

(a) Only 60–80% of rain reaches the ground on a forested slope.
Explain what happens to the remainder.

.....

.....

.....[2]

(b) Why does the groundwater level sink after deforestation?

.....

.....

.....[2]

(c) State **one** other problem associated with deforestation of a slope.

.....

.....[1]

11 (a) Dirty water is a major contributor to the spread of diseases. Some of these diseases are shown in Table 11.1.

Complete Table 11.1.

Table 11.1

disease	causative organism	vector	method of control
schistosomiasis (bilharzia)	schistosoma		
malaria			drain stagnant pools where vector breeds
cholera		flies	

[6]

[Turn over

(b) Fig. 11.1 shows an area in China where a dam is being built on the Yangtze river. The shaded area shows the land that will be flooded when the dam is built. Water level will be raised by up to 70 m.

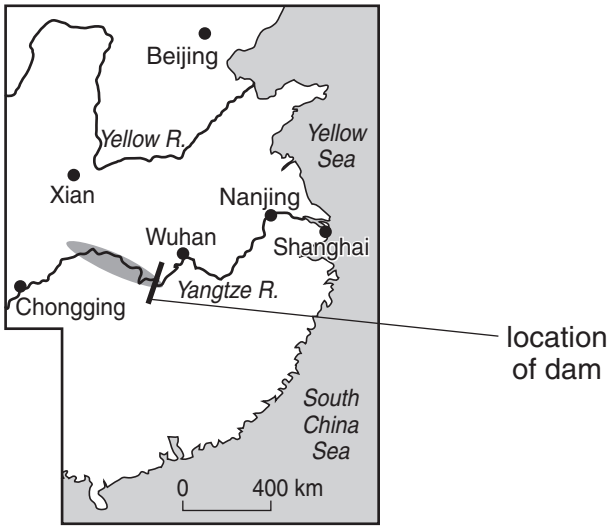

Fig. 11.1

(i) Suggest two advantages that the dam may bring.

1. .....

.....

2. .....

.....[2]

(ii) Suggest two problems that may arise from the construction of the dam.

1. .....

.....

2. .....

.....[2]

12 **(a)** Eutrophication is a natural process.

What is *eutrophication*?

.....

.....[1]

(b) State two ways in which human activities can accelerate eutrophication.

1. .....

.....

2. .....

.....[2]

(c) Outline the consequences of rapid eutrophication in a lake.

.....

.....

.....

.....

.....[3]

[Turn over

13 Domestic waste is often disposed of in landfill sites. Fig. 13.1 shows a cross-section of the structure of a landfill site.

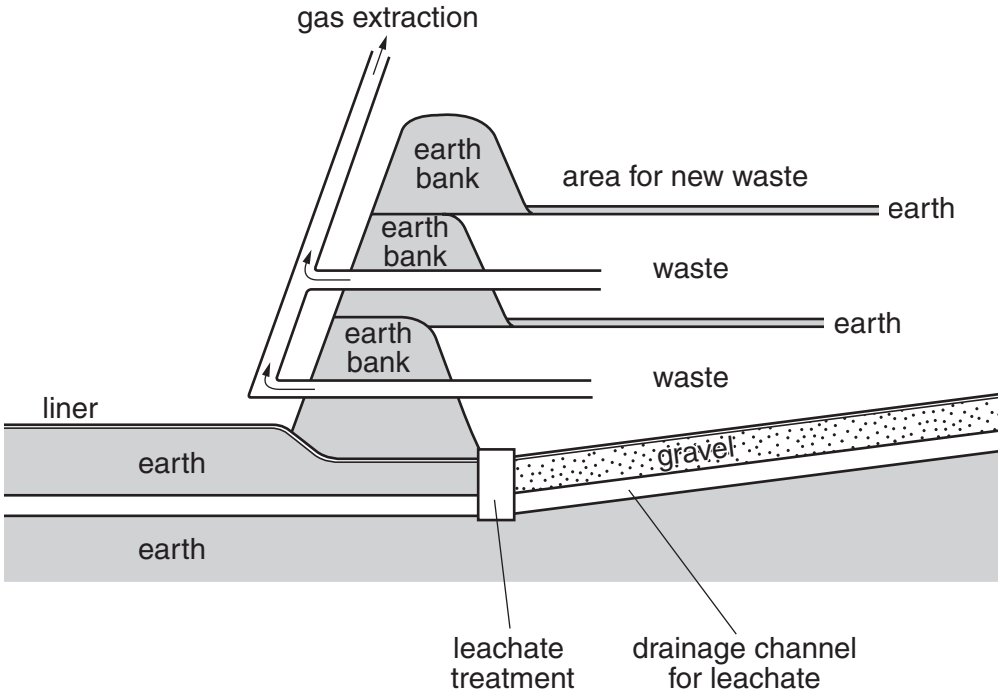

Fig. 13.1

(a) What is the purpose of the liner?

.....[1]

(b) (i) What is *leachate*?

.....

.....[2]

(ii) Why is it hazardous?

.....

.....[2]

(c) (i) Why is each layer of waste covered with earth?

.....[1]

(ii) Suggest a disadvantage of having to do this.

.....[1]

(d) State two advantages of landfill as a means of disposing of waste.

1. .....

.....

2. .....

.....[2]

14 (a) Fig. 14.1 shows a soil profile of a *podzol*.

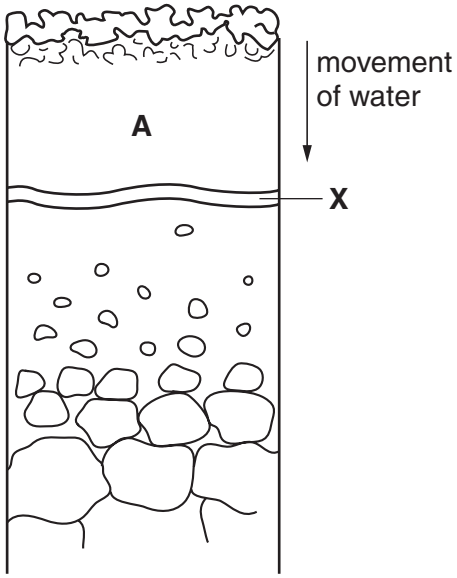

Fig. 14.1

(i) What does horizon **A** look like?

.....[1]

(ii) What happens in horizon **A** to create this appearance?

.....

.....

.....[2]

(iii) The formation of **X** is characteristic of a podzol. What is **X**?

.....[1]

(iv) State **one** problem caused by **X**.

.....

.....[1]

(b) Fig. 14.2 shows the way in which soil *salinisation* can occur when soil is irrigated using open channels.

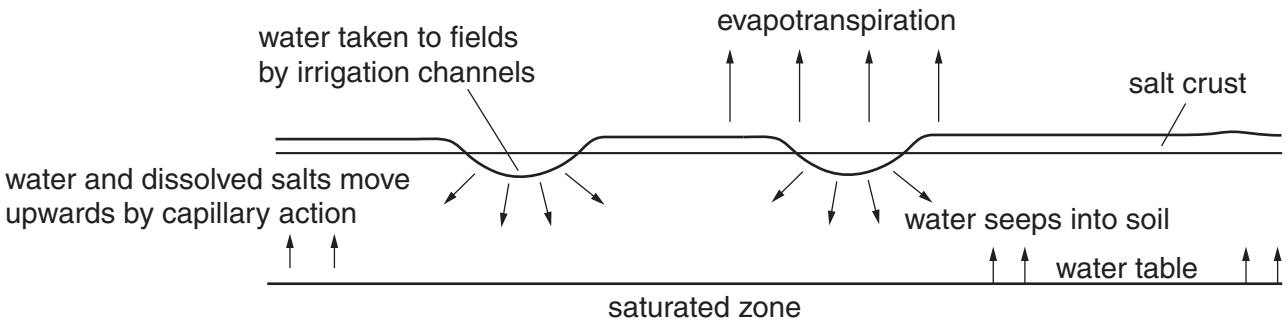

Fig. 14.2

(i) Why is salinisation a problem?

.....

.....

.....[2]

(ii) Suggest why lining the irrigation channels can help to prevent salinisation where open channel irrigation is used.

.....

.....[1]

(iii) Outline **one** method of reclaiming land, where soil salinity exists.

.....

.....

.....[2]

Answer this question on the separate answer paper provided.

15 (a) Describe the ways in which minerals have been formed in the Earth's crust. [7]

(b) (i) Explain what is meant by a *bulk material*. [2]

(ii) Describe environmental problems associated with methods of obtaining bulk materials. [6]

OPTION 3 - THE CONSERVATION OF BIOLOGICAL RESOURCES

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

16 (a) The oceans' fish stocks must be managed if they are to be maintained.

The biomass of a fish stock can be calculated from the following equation.

$$S_n = S_{n-1} + G + R - M - C$$

S_n is the biomass now,

S_{n-1} is the biomass one year ago,

G is biomass added by the growth of fish,

R is biomass added by recruitment (birth of fish),

M is biomass lost by death,

C is biomass caught.

When the fish catch reaches the maximum sustainable yield the population remains stable.

In other words $S_n = S_{n-1}$ and $(G+R) = (M+C)$.

(i) If $(G+R)$ is greater than $(M+C)$, what will be the result?

.....[1]

(ii) Suggest **one** reason why it is difficult to calculate S_n accurately.

.....

.....[1]

(b) (i) State two ways in which fishing can be controlled to prevent stocks being depleted.

1. .....

.....

2. .....

.....[2]

(ii) Suggest **one** reason why controls may not be effective.

.....

.....[1]

(c) State **one** advantage and **one** disadvantage of fish farming.

advantage .....

.....

disadvantage .....

.....[2]

[Turn over

17 **(a)** Crops on land next to a lake are sprayed with insecticide. This insecticide affects the ability of birds to lay viable eggs. Fig. 17.1 shows a food chain found in the lake and the concentration of insecticide in parts per million (ppm), by mass, in each organism in the chain.

plankton	→	small fish	→	large fish	→	fish-eating bird
3×10^{-6} ppm		0.5 ppm		2 ppm		25 ppm

Fig. 17.1

(i) Suggest two ways in which the insecticide can get into the water in the lake.

1. .....

2. .....[2]

(ii) Explain why the bird contains such a large concentration of insecticide, compared to the plankton.

.....

.....

.....

.....[3]

(b) Antibiotics are given to farm livestock to prevent bacterial infections such as *Salmonella*, which can also affect humans. Strains of *Salmonella*, which are resistant to antibiotics, have appeared.

(i) How does antibiotic resistance in *Salmonella* arise?

.....

.....

.....

.....

.....[4]

(ii) Why is the occurrence of antibiotic-resistant *Salmonella* of concern to humans?

.....

.....[1]

18 **(a)** List four economic products obtained from grazing animals.

1. .....

2. .....

3. .....

4. ..... [2]

Dry areas of North Africa have been populated traditionally by nomadic people, whose grazing animals moved from pasture to pasture with them. In recent years there has been an increasing trend for these people to leave the nomadic life and settle in villages with their flocks.

(b) What are the likely results of this constant use of grazing close to the village?

.....

.....

.....

.....[3]

(c) Goats are better adapted than sheep to eating a wider range of plant material. Since the settling of the nomads, the proportion of goats to sheep in flocks has increased.

(i) Suggest a reason for this.

.....

.....[1]

In years with low rainfall, surface leaf litter may make up 89% of the daily diet of a sheep and 61% of the daily diet of a goat.

(ii) Why does leaf litter make up a higher proportion of a sheep's diet than that of a goat?

.....

.....[1]

(iii) Suggest **one** environmental problem that may arise from this consumption of surface leaf litter.

.....

.....[1]

19 Fig. 19.1 shows a method of cultivating sloping land. It uses double rows of small trees planted along the contours. Crops are grown in the spaces between the rows of trees.

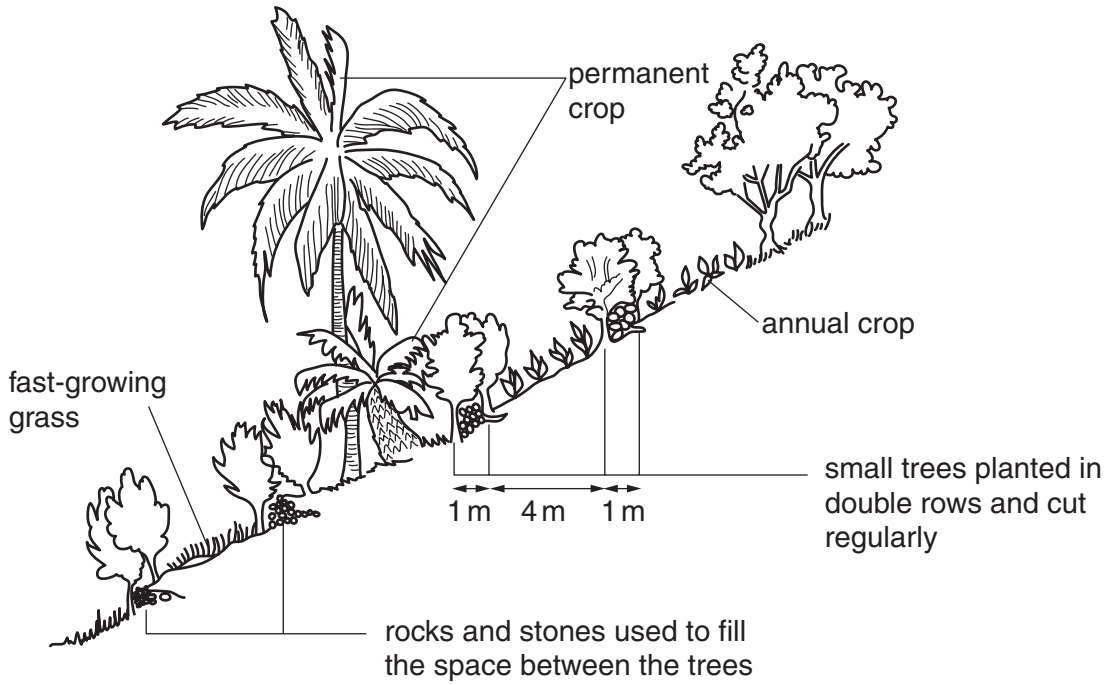

Fig. 19.1

(a) (i) How do the rows of trees prevent erosion?

.....

.....

.....

.....[2]

(ii) Suggest **one** purpose of filling the space between the trees with stones and rocks.

.....

.....[1]

(iii) Some of the strips between the trees are planted with permanent crops of fruit trees. Once these trees are established, weeds are allowed to grow around them.

Suggest **one** reason for this.

.....

.....[1]

(iv) Some of the cultivated strips are planted with grass which can be cut for animal fodder. The grass species used are fast-growing and have strong roots.

What are the advantages of this?

.....

.....

.....

.....[2]

(b) In developing countries, wood is the main fuel but increasing demand for wood is reducing supply. Farmers in rural areas are increasingly using cattle dung as fuel.

What effect will this have on the soil?

.....

.....

.....

.....[3]

20 The tiger is an endangered species. It has no natural predators. Its habitat is forest but, with the reduction in forested areas, it may venture into populated areas and kill livestock for food. The largest numbers are now found in India, where a rapid increase in human population, together with an increased need for fuel wood and the keeping of increasing numbers of livestock, has led to deforestation. The tiger's skin and its body parts, which are used in many traditional medicines, can be sold for a high price. Hunting is prohibited in the forest reserves, where most tigers are found, but this is difficult to police.

(a) Suggest three things that threaten tiger populations.

1. .....

2. .....

3. .....[3]

(b) Forest reserves have been set aside for tigers. These reserves are linked, where possible by narrow "corridors" of forest, to enable tigers to move from one reserve to another. Scientists believe that a breeding population of tigers should have at least 500 animals but populations on most reserves consist of less than 100 animals.

(i) Why is it important that tigers should be able to move from one reserve to another?

.....

.....

.....[1]

(ii) How will very small populations of tigers affect the ability of the species to adapt to changes in the environment?

.....

.....

.....[2]

Answer this question on the separate answer paper provided.

21 **(a)** Describe the principles of *genetic engineering* and the ways in which it can be used. [7]

(b) Outline the advantages of genetic engineering and the problems that may arise. [8]