CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Subsidiary Level

ENVIRONMENTAL SCIENCE　　　　　　　**8290/1**

PAPER 1

OCTOBER/NOVEMBER SESSION 2002

1 hour 45 minutes

Candidates answer on the question paper.
No additional materials are required.

TIME　　1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The marks allocated are an indication of the length of answer required.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

This question paper consists of 21 printed pages and 3 blank pages.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

Answer **all** questions.

1 Figs. 1.1 to 1.5 show how the existing continents were formed from one supercontinent over a period of 200 million years.
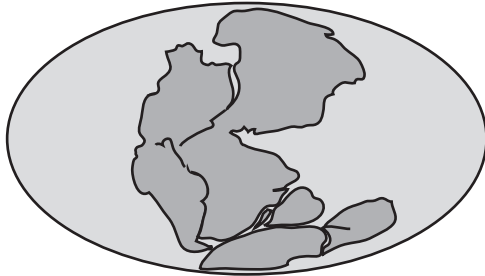
Fig. 1.1
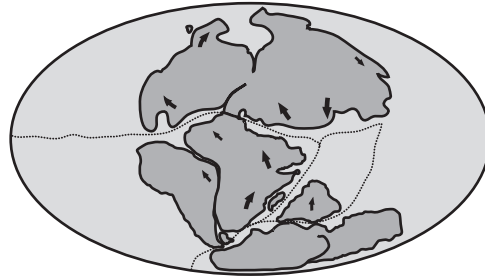
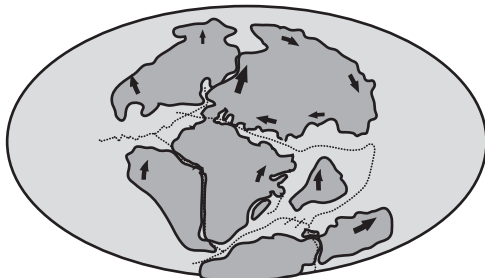**Fig. 1.2**

Fig. 1.3

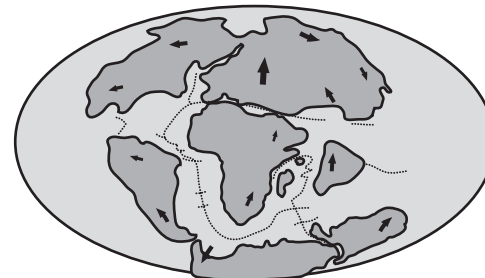**Fig. 1.4**
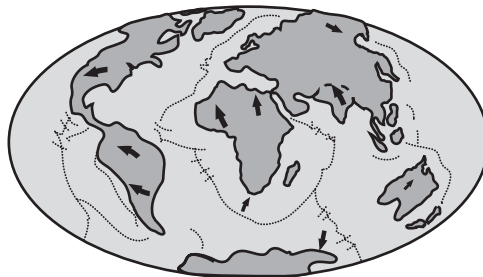
Fig. 1.5

(a) What term is used to describe the slow movement of land masses illustrated in Figs. 1.1 to 1.5?

....[1]

 (b) (i) State the name of the original supercontinent shown in Fig. 1.1.

....[1]

   (ii) State the name of **one** of the continents shown in Fig. 1.2.

....[1]

  (iii) What term is used to describe the areas enclosed by the dotted lines in Figs.1.2 to 1.5?

....[1]

 (c) The areas shown in Figs. 1.2 to 1.5 float on the mantle and move.

   (i) Outline what is meant by the term *mantle*.

....

....[2]

   (ii) Explain why the areas float on the mantle.

....

....[1]

  (iii) Explain why the areas move.

....

....[1]

[Turn over

(d) The evidence that South America and Africa were linked includes 'continental fit', shared fossils and shared geology.
By drawing one or more diagrams, explain this statement.

[3]

2 The texture of soil, from which stone and coarse sand have been removed, can be investigated by sedimentation. A weighed sample is placed in a beaker of water, shaken and then allowed to settle. The result of such a procedure is shown in Fig. 2.1.
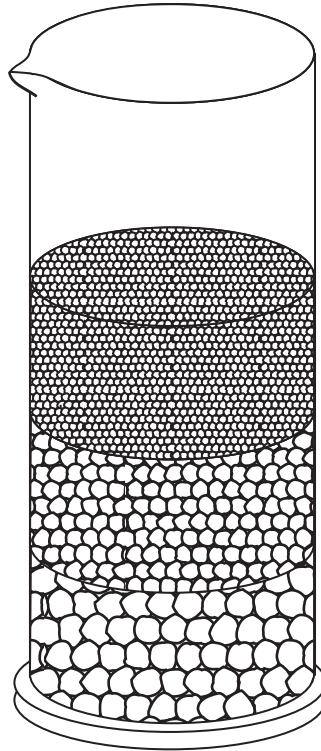
Fig. 2.1

(a) Label the sand and silt layers shown in Fig. 2.1. [1]

(b) Explain why three separate layers form.

....

....[2]

[Turn over

The textural composition of a soil can be illustrated by the triangular diagram Fig. 2.2.
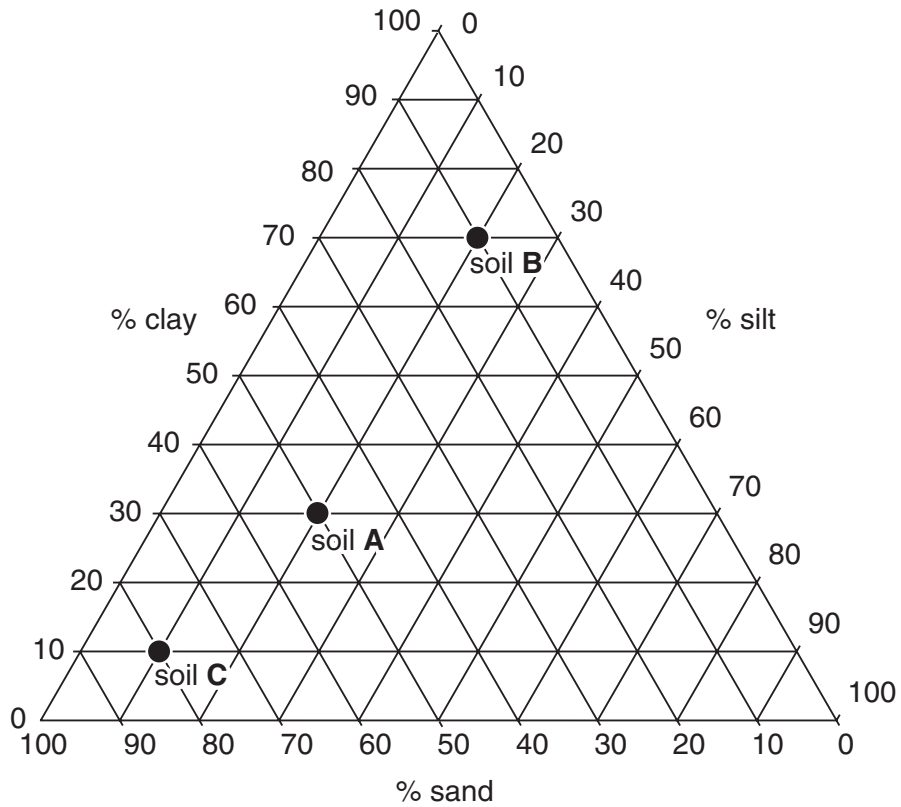
Fig. 2.2

(c) Deduce the textural composition of soils **A**, **B** and **C**.

Soil **A** ....

Soil **B** ....

Soil **C** ....[3]

(d) Explain why the three soils **A**, **B** and **C** are likely to have different properties.

....

....

....

....[3]

(e) A vertical section of a soil is known as a soil profile. Fig. 2.3 shows a general soil profile with five different horizons.

Fig. 2.3

By using the terms listed below, label the horizons shown in Fig. 2.3.

eluvial   **illuvial**
organic   **parent rock**
weathered mineral   [2]

[Turn over

3 Figs. 3.1 and 3.2 show mean annual temperature ranges and mean annual rainfall isopleths for South Island, New Zealand.

| Fig. 3.1 | Fig. 3.2 |

(a) Describe briefly two features of the mean annual temperature distribution.

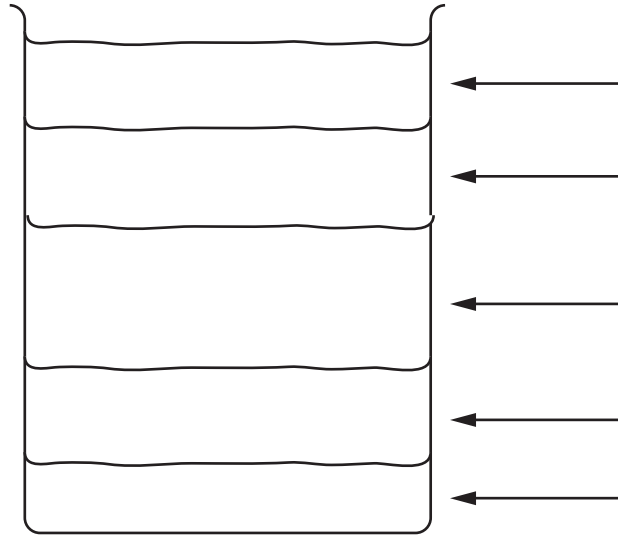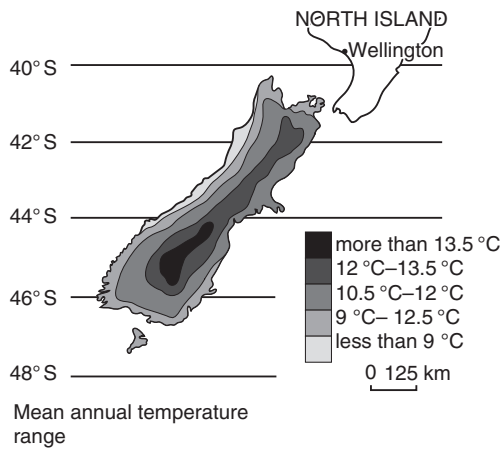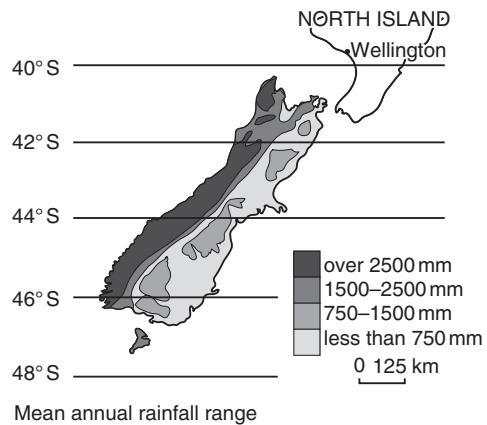1. ....

....

2. ....

....[2]

(b) Suggest **one** possible explanation for the location of the region with the largest mean annual temperature range.

....

....

....[3]

(c) (i) Briefly describe **one** feature of the distribution of mean annual rainfall.

....

....[1]

(ii) Suggest an explanation for this feature.

....

....

....

....[3]

(d) Fig. 3.3 shows the mean isotherms in July (adjusted to sea level) for South Island.

Mean isotherms for July
(adjusted to sea level)
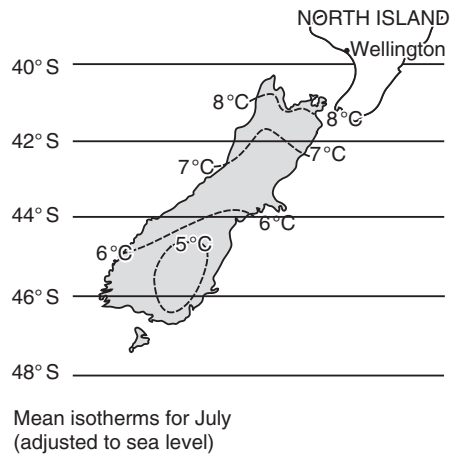
Fig. 3.3

Suggest why places at the same latitude on the west and east coasts do not have the same mean temperature.

....

....

....[2]

[Turn over

4 Fig. 4.1 shows some annual flows of nitrogen in a grassland on which cattle graze.

Fig. 4.1

(a) Use the letters **A** to **O** to identify each of the following.
Each letter may be used once, or not at all.

(i) .... represents a flow of nitrogen due to lightning.

(ii) .... represents a flow of nitrogen due to the industrial production of ammonia.

(iii) .... represents a flow of nitrogen due to bacterial denitrification.

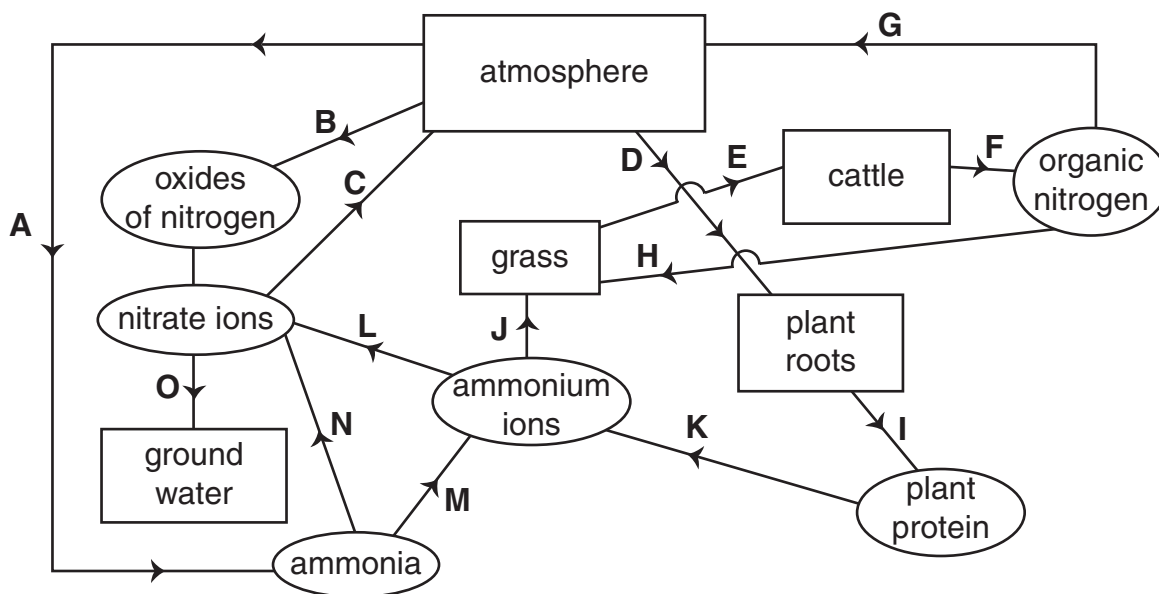**(iv)** .... represents a flow of nitrogen due to nitrogen fixing bacteria.

(v) .... represents a flow of nitrogen due to the addition of manure.

(vi) .... represents leaching.

[6]

(b) Outline two ways in which humans have greatly influenced the nitrogen cycle.

1. ....

....

2. ....

....[2]

5 **(a)** Describe how ozone is formed in the stratosphere.

....

....

....[2]

(b) Describe how the breakdown products of CFCs destroy ozone in the stratosphere.

....

....

....[2]

Fig. 5.1 shows the mean concentrations of stratospheric ozone over the southern hemisphere in 1990.
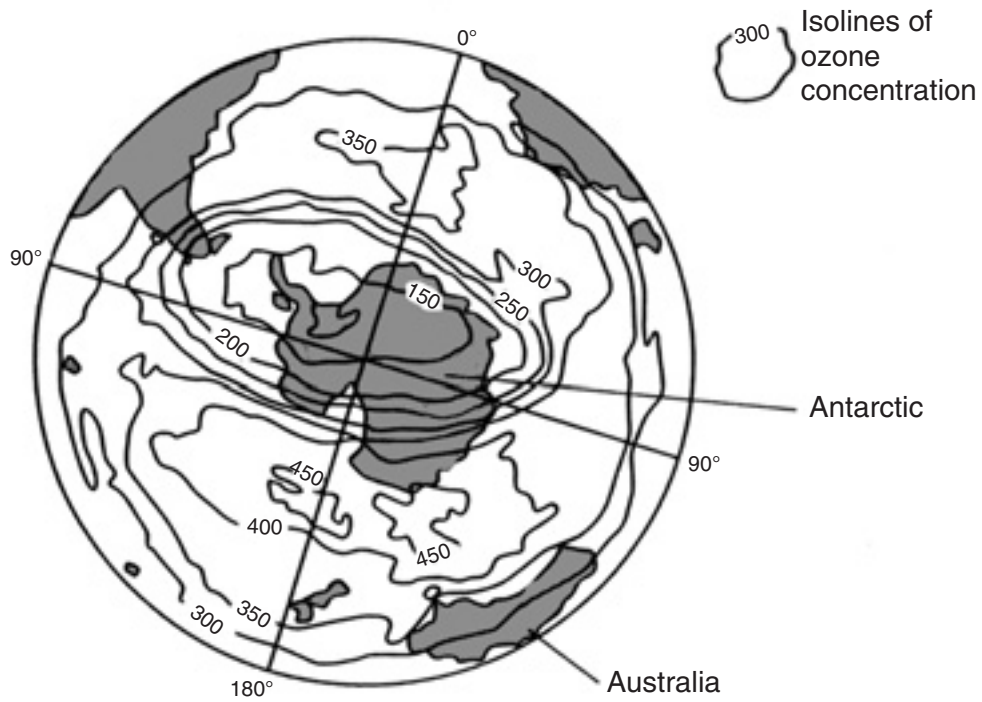
Fig. 5.1

(c) Describe the overall pattern of ozone concentration.

....

....[2]

(d) Explain what happens when stratospheric ozone absorbs ultraviolet radiation.

....

....

....

....[1]

(e) Outline **one** way in which attempts are being made to reduce the effects of CFCs on stratospheric ozone.

....

....

....[1]

6 Fig. 6.1 shows the Earth, tilted at an angle of α degrees to the vertical, as it orbits the Sun. The northern hemisphere is inclined towards the Sun and the daylight hours are decreasing in length at place **A**.
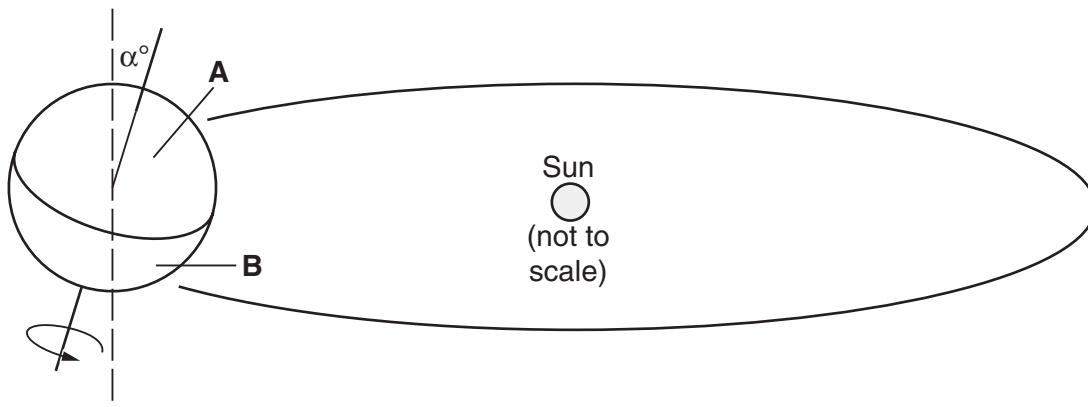

Fig. 6.1

(a) (i) How long does it take for the Earth to make one revolution about its axis?

....

(ii) How long does it take, in days, for the Earth to rotate four times round the Sun?

....

(iii) State the value of the angle $\alpha°$. ....

(iv) State what season of the year it is at place **A** ....
[4]

(b) Place **B** is at the same distance from the equator as place **A**. Show by means of a diagram on Fig. 6.1, the position of the Earth when place **B** experiences the same length of daylight hours as that shown for place **A**.
On your diagram you should show the Earth as a circle and you should also indicate $\alpha°$, the angle of tilt. [2]

(c) Figs. 6.2 and 6.3 show how the intensity of the electromagnetic radiation emitted by the Sun and from the Earth vary with wavelength.
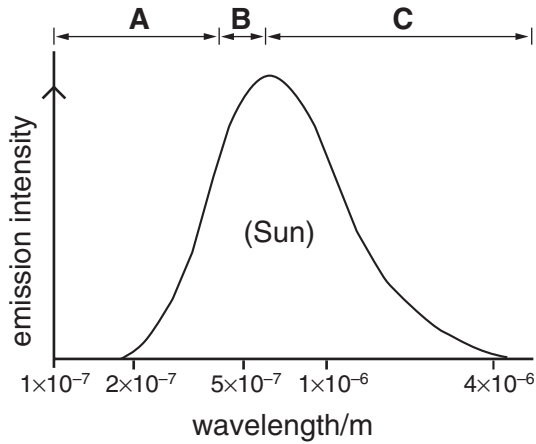

Fig. 6.2
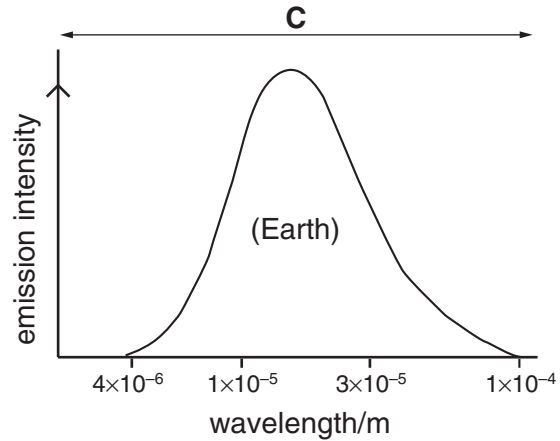
Fig. 6.3

(i) Name the regions of the spectrum **A**, **B** and **C**.

A is ....   **B** is ....

C is ....

[1]

(ii) Explain why the average wavelength of electromagnetic radiation emitted from the Earth is longer than that emitted by the Sun.

....

....[1]

[Turn over

7 Fig. 7.1 shows how the carbon dioxide concentration in the atmosphere has varied over a period of about 30 years.

Fig. 7.1

(a) Describe the trend in carbon dioxide concentration indicated by the graph in Fig. 7.1.

....
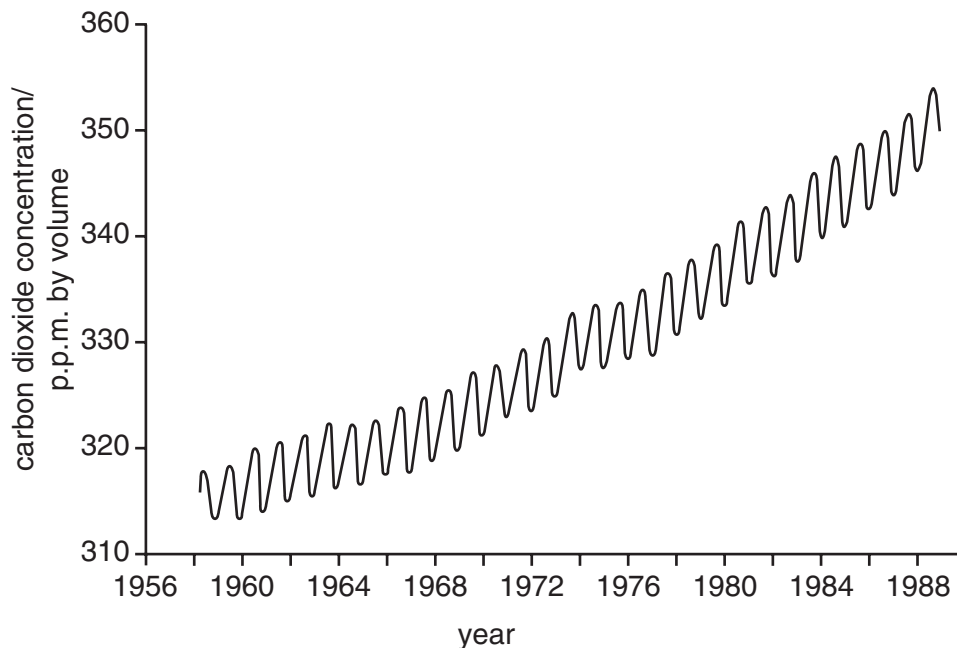
....

....

....[2]

(b) Explain why there is an annual peak and an annual trough in the concentration of atmospheric carbon dioxide.

....

....

....

....[2]

Carbon dioxide, methane and nitrogen oxides are sometimes referred to as 'greenhouse gases'. Their atmospheric concentrations and relative contributions to the 'greenhouse effect' are shown in Fig. 7.2.

gas	concentration / ppm by volume	rate of increase per year / ppm by volume	percentage contribution to 'greenhouse effect'
carbon dioxide	353	1.8	72
methane	1.72	0.015	18
nitrogen oxides	0.310	0.0008	10

Fig. 7.2

(c) State **one** source of each of these gases.

carbon dioxide ....

methane ....

nitrogen oxides ....

[2]

(d) Name the gas which is increasing in concentration at the highest percentage rate and calculate the value of its percentage rate of increase. Show your working.

Name of the gas ....

Percentage rate of increase

[2]

(e) The percentage contribution that each gas makes to the 'greenhouse effect' does not depend upon concentration alone.
Suggest **one** reason why a nitrogen oxide molecule makes a lower contribution to the 'greenhouse effect' than a carbon dioxide molecule.

....

....[1]

[Turn over

8 The world can be divided into eight major biomes.

Fig. 8.1 shows a map of the approximate distribution of all eight major biomes.

The names of four major biomes (desert, savannah, tropical rainforest and tundra) have been omitted from the key

Fig. 8.2 shows a graph of the distribution of four of the biomes named above, in terms of mean annual precipitation and mean annual temperature.
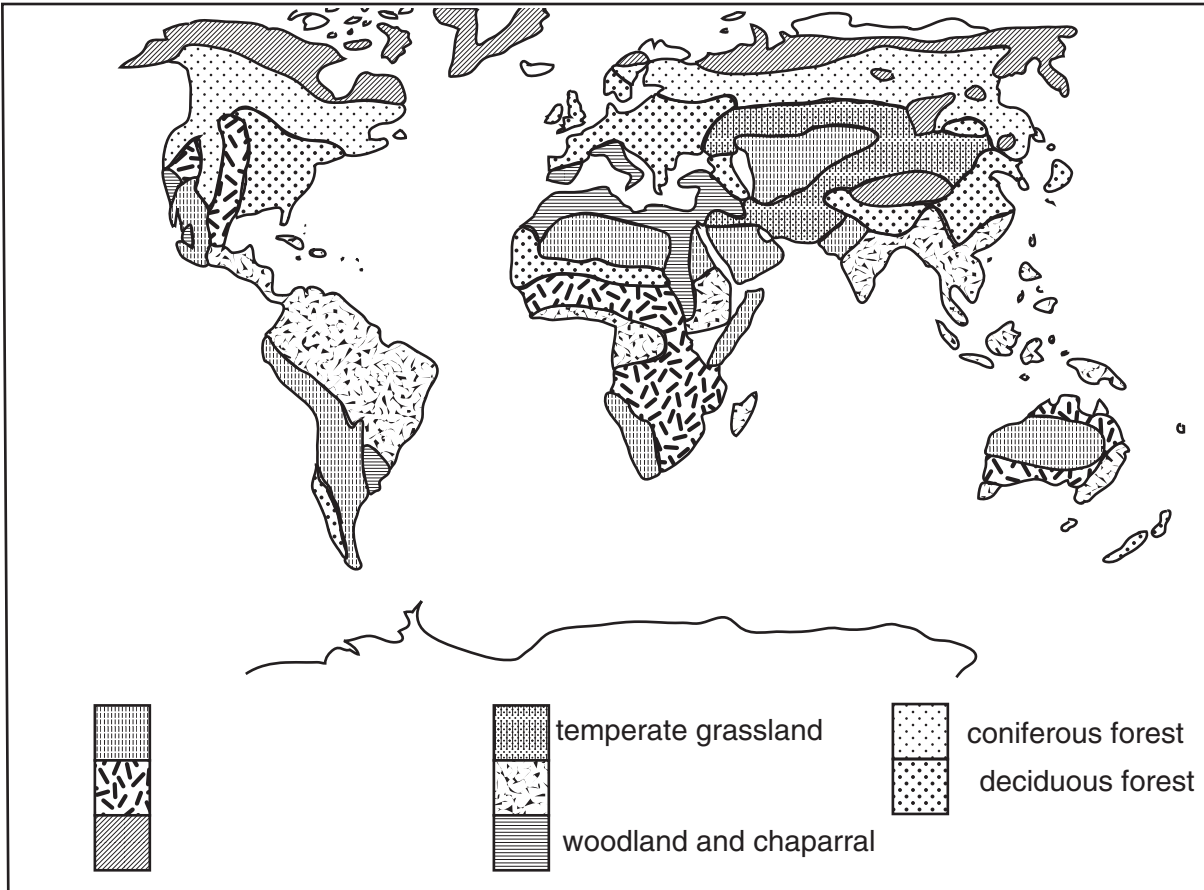

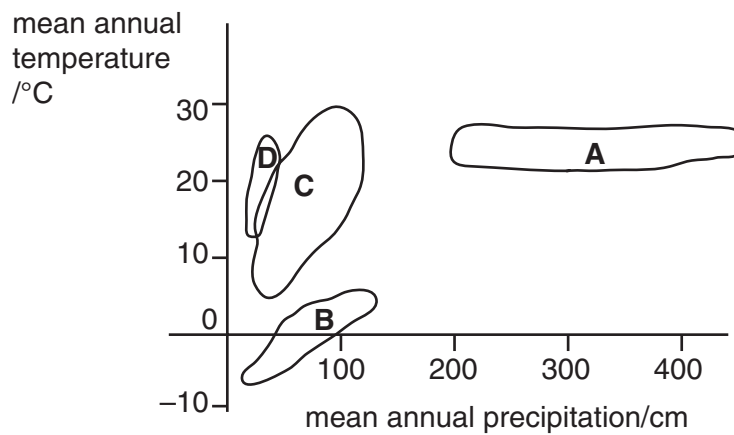temperate grassland

coniferous forest

deciduous forest

woodland and chaparral

Fig. 8.1

Fig. 8.2

(a) (i) Explain what is meant by the term *biome*.

....

....[2]

(ii) By completing the key in Fig. 8.1, identify the four unlabelled biomes.   [2]

(iii) Identify the four biomes shown in Fig. 8.2.

A is ....   **B** is ....

C is ....   **D** is ....

[4]

(b) The Net Primary Productivity (NPP) of a biome is the annual mass of dry matter produced per square metre due to plant growth. Fig. 8.3 shows the NPP of four biomes.

biome	NPP / g
tropical rain forest	2200
savanna	900
desert	90
tundra	140

Fig. 8.3

(i) Explain why tropical rain forests have a high NPP.

....

....

....[2]

(ii) Explain why tundra has a higher NPP than deserts.

....

....

....[2]

[Turn over

9 Large populations of lynx and snowshoe hares live in an area of Canada around Hudson Bay. Lynx are carnivores and snowshoe hares are herbivores. Both species were hunted by trappers over a ninety year period. The numbers of both species that were caught each year were recorded. The results are shown in Fig. 9.1.
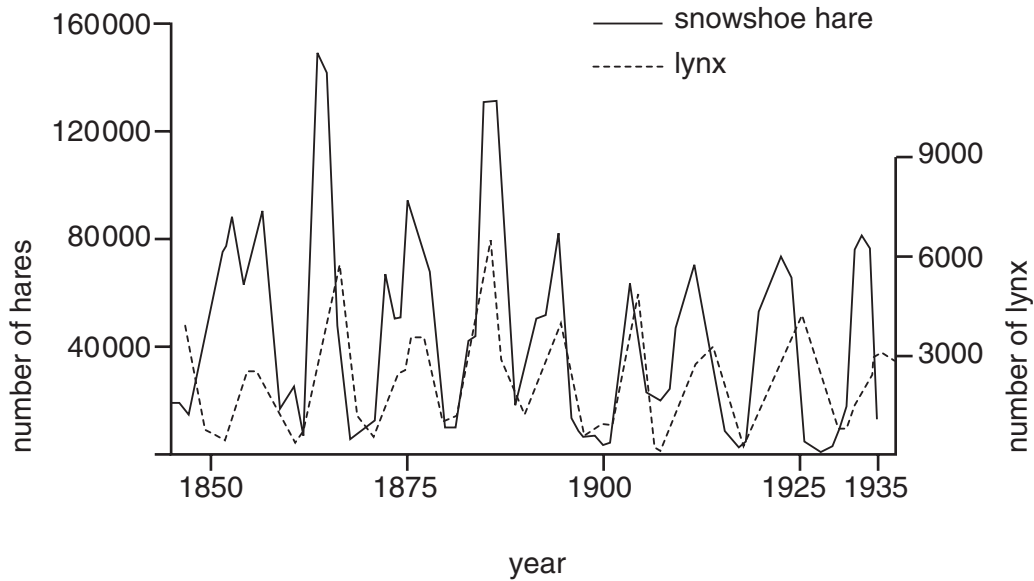

Fig. 9.1

(a) Carnivores and herbivores are not the only types of feeders that are found in many ecosystems.
Name two other types of feeders found in ecosystems.

1. ....

2. ....[2]

(b) The major trophic relationship of the lynx population was with the snowshoe hare population.
Explain what is meant by this statement.

....

....[1]

(c) **(i)** What was the largest number of snowshoe hares that were caught in a year?

....[1]

(ii) Your answer can be converted into an estimate of the snowshoe hare population density for that year.
What further information would you need in order to make the estimate?

....

....

....[1]

(d) Describe the trends shown in Fig. 9.1 in the numbers of lynx and snowshoe hares that were caught.

....

....

....[2]

(e) Suggest an explanation for the changes in the lynx population shown in Fig. 9.1.

....

....

....

....[3]

(f) On some islands in Hudson Bay there are populations of snowshoe hares and other herbivores but there are no carnivores. The populations of snowshoe hares on these islands have been studied. The results are shown in Fig. 9.2.
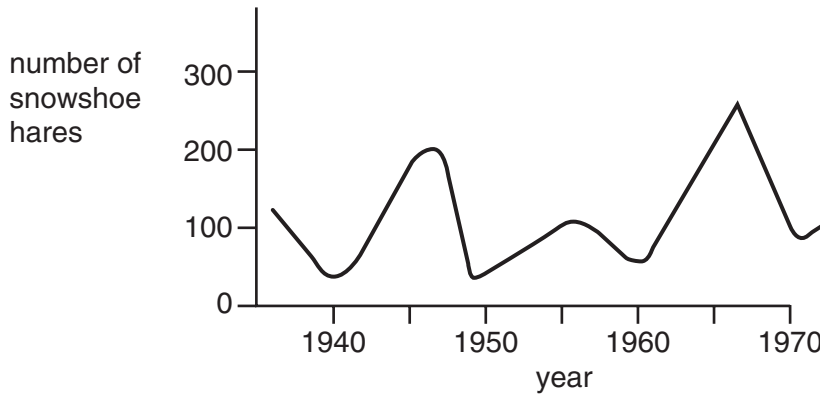
number of
snowshoe
hares

300 —
200 —
100 —
0 —

1940   1950   1960   1970

year

Fig. 9.2

Suggest an explanation for the changes to the snowshoe hare population shown in Fig. 9.2.

....

....

....

....[3]

[Turn over

10   Fig. 10.1 shows population pyramids for four different countries, **A**, **B**, **C** and **D**.
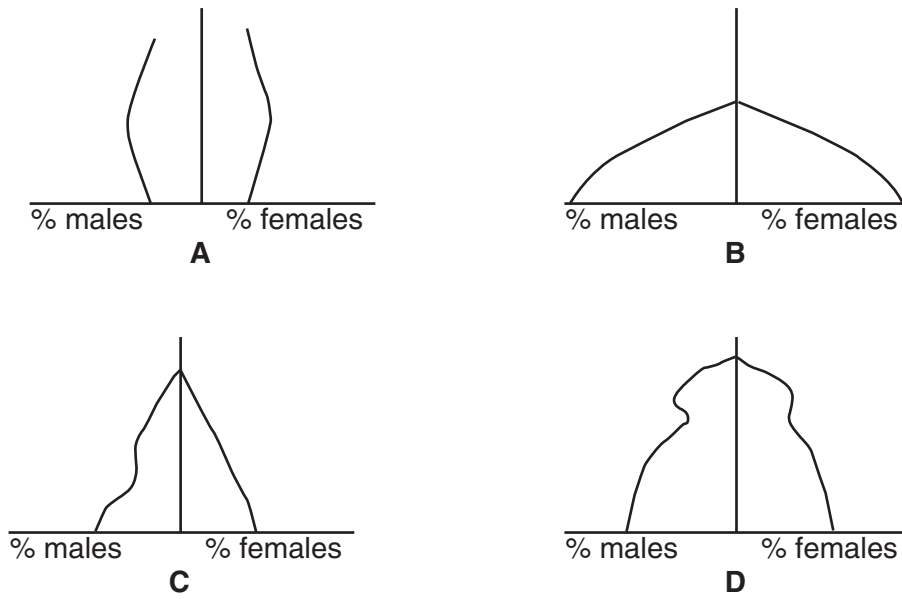

Fig. 10.1

(a) By using each of the letters **A**, **B**, **C** or **D** once only, indicate which pyramid best illustrates a population which

   (i)   has a high birth rate and low life expectancy; ....

   (ii)   experiences the loss of young male adults to find work elsewhere; ....

   (iii)   is declining in number;........................

   (iv)   suffered a major war forty years ago. ....

[4]

Fig. 10.2 shows population pyramids for three countries, **X**, **Y** and **Z**.
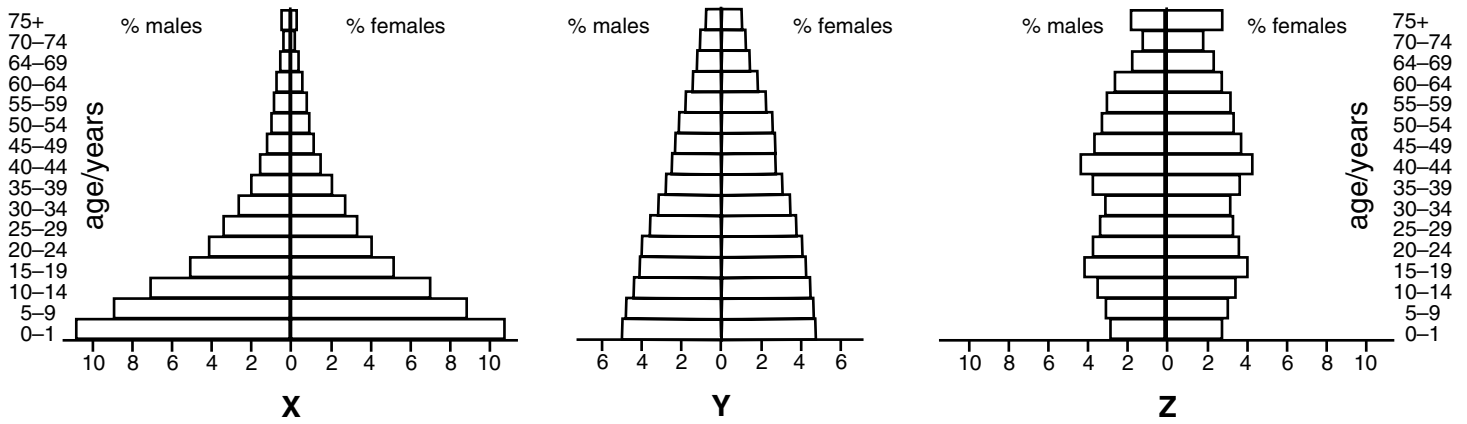
Fig. 10.2

(b) Identify which is the population pyramid for an industrialised country.

.... [1]

(c) Suggest an explanation for the shape of the population pyramid for country **Z**.

....

....[1]

(d) Suggest cultural or economic or social reasons for the fact that the pyramids have different shapes.

....

....

....

....

....

....[3]

22

BLANK PAGE

23

BLANK PAGE

24

BLANK PAGE