



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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8291/23

May/June 2022

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [].

This document has **24** pages. Any blank pages are indicated.

- 1 In 2017, the United Kingdom generated electricity for 24 hours without using coal.

During these 24 hours, half of the energy came from natural gas and a quarter came from nuclear power. Wind, biomass and imported sources of energy were also used.

- (a) (i) Explain why alternative fuels to coal are needed for electricity generation.

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..... [3]

- (ii) Suggest **two** reasons why the electricity generated from wind power was less than a quarter of the total.

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[2]

- (iii) Outline the disadvantages of using imported sources of energy for electricity generation.

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..... [2]

- (iv) Explain why burning biomass, such as wood pellets, can be described as carbon neutral.

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..... [2]

- (b) In 2020, the domestic use of coal and wet wood started to be phased out in the UK.

Wet wood is undried wood, with a moisture content of at least 20%. Wet wood produces more smoke and particulates than dry wood when burned.

Describe how burning wet wood impacts human health.

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..... [3]

- (c) Fig. 1.1 shows the percentage contribution of different energy sources to world electricity production from 1985 to 2019.

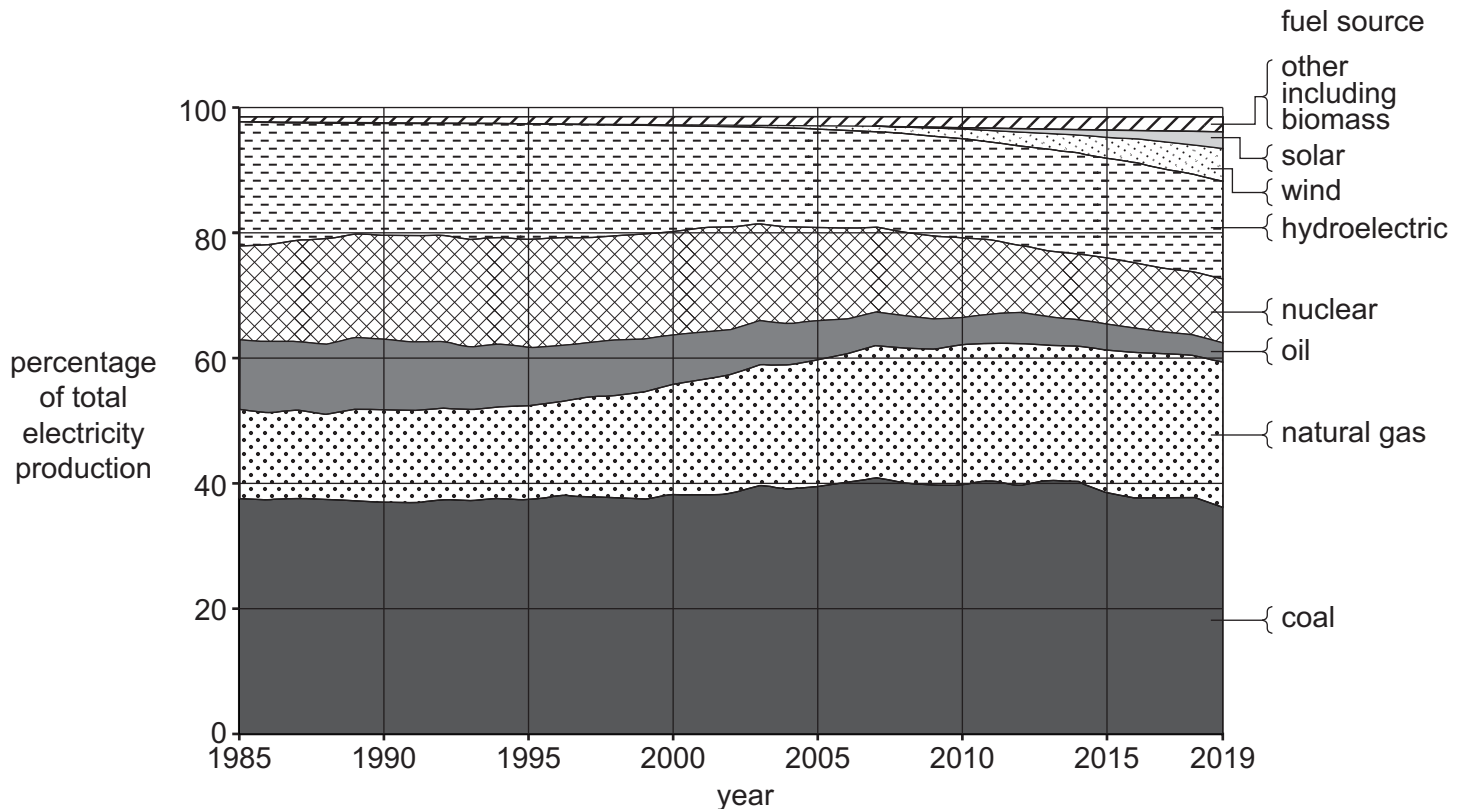


Fig. 1.1

- (i) Identify which fuel source has decreased its contribution to total electricity production by the greatest percentage since 1985.

..... [1]

- (ii) Use Fig. 1.1 to compare the trends shown for the contribution of coal and nuclear energy to total electricity production from 1985 to 2019.

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- (iii) The trend for natural gas shows an increase in its percentage contribution to total electricity production since 1985.

Suggest reasons for this trend.

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[Total: 19]

- 2 (a) The bar chart in Fig. 2.1 shows the mass of waste disposed of using landfill and recycling for seven countries in Europe in 2016.

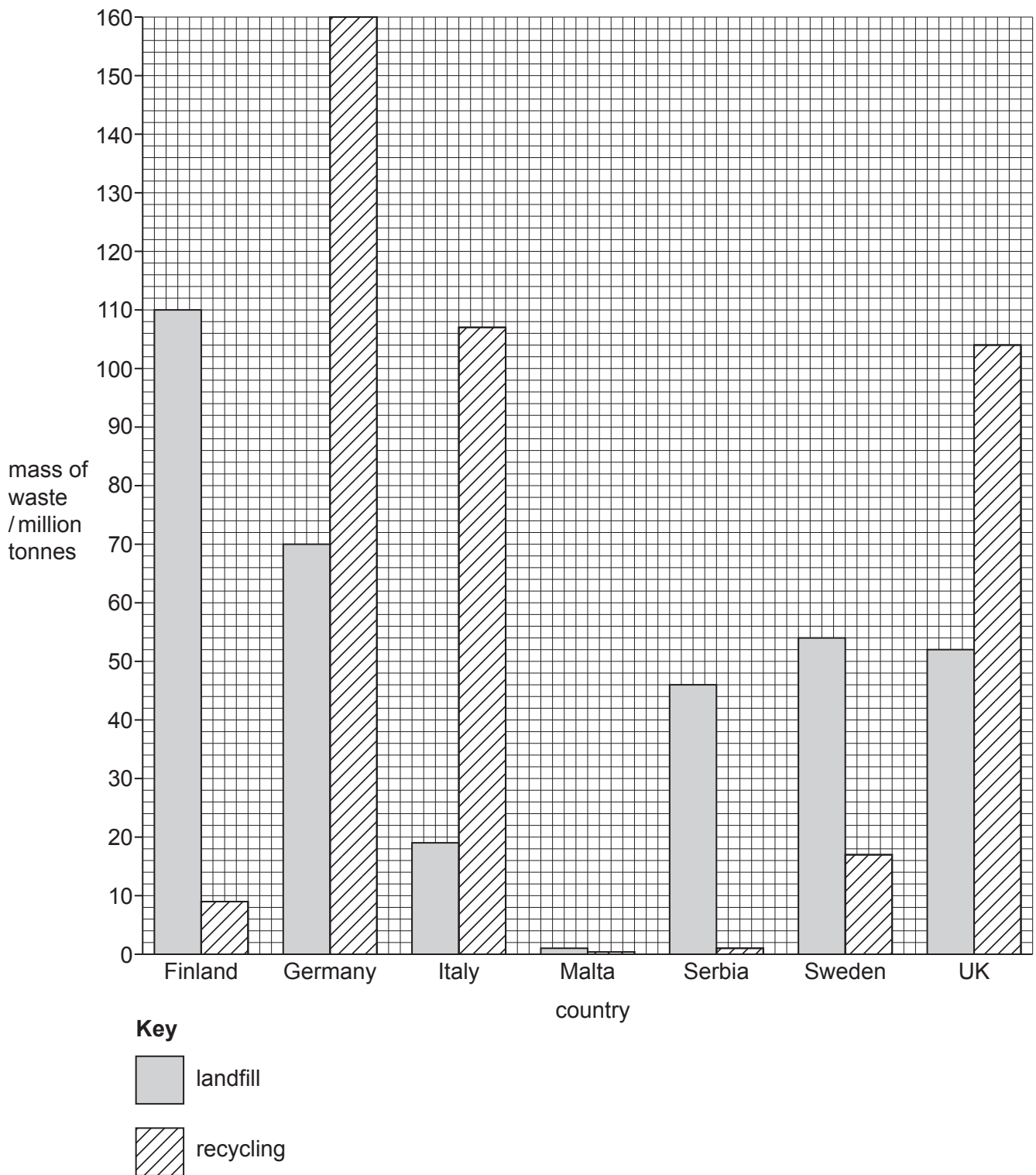


Fig. 2.1

- (i) Identify the number of countries in 2016 that disposed of more of their waste using landfill than recycling.

[1]

- (ii) The total mass of waste disposed of in Germany in 2016 was 380 million tonnes.

Calculate the percentage of waste disposed of using landfill.

Give your answer to the nearest whole percentage.

percentage = [2]

- (iii) Suggest a limitation of using the data in Fig. 2.1 to compare waste disposal methods in different countries.

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 [1]

- (iv) Describe the impacts of using landfill as a method of waste disposal.

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 [5]

- (v) State **one** strategy to increase the amount of waste recycling.

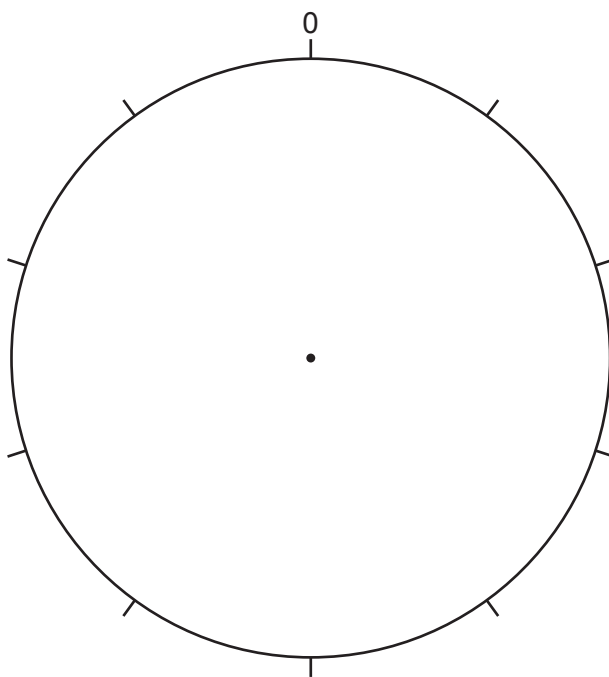
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 [1]

- (b) Table 2.1 shows the percentage of waste produced by different economic activities in some European countries in 2016.

Table 2.1

economic activity	percentage
construction	37
rock extraction	26
manufacturing	13
water treatment	10
domestic	9
other	5

- (i) Draw a pie chart of the data in Table 2.1. Complete the key.



Key

☐	
☐	
☐	
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☐	

[3]

- (ii) Suggest why investment in strategies to reduce domestic waste is unlikely to reduce Europe's overall waste production.

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..... [1]

(c) Explain how waste incineration can benefit a country.

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..... [2]

[Total: 16]

- 3 (a) A conservationist uses aerial photographs to estimate the population of a species of bird.

Fig. 3.1 shows a drawing of the position of some birds from an aerial photograph using a grid.

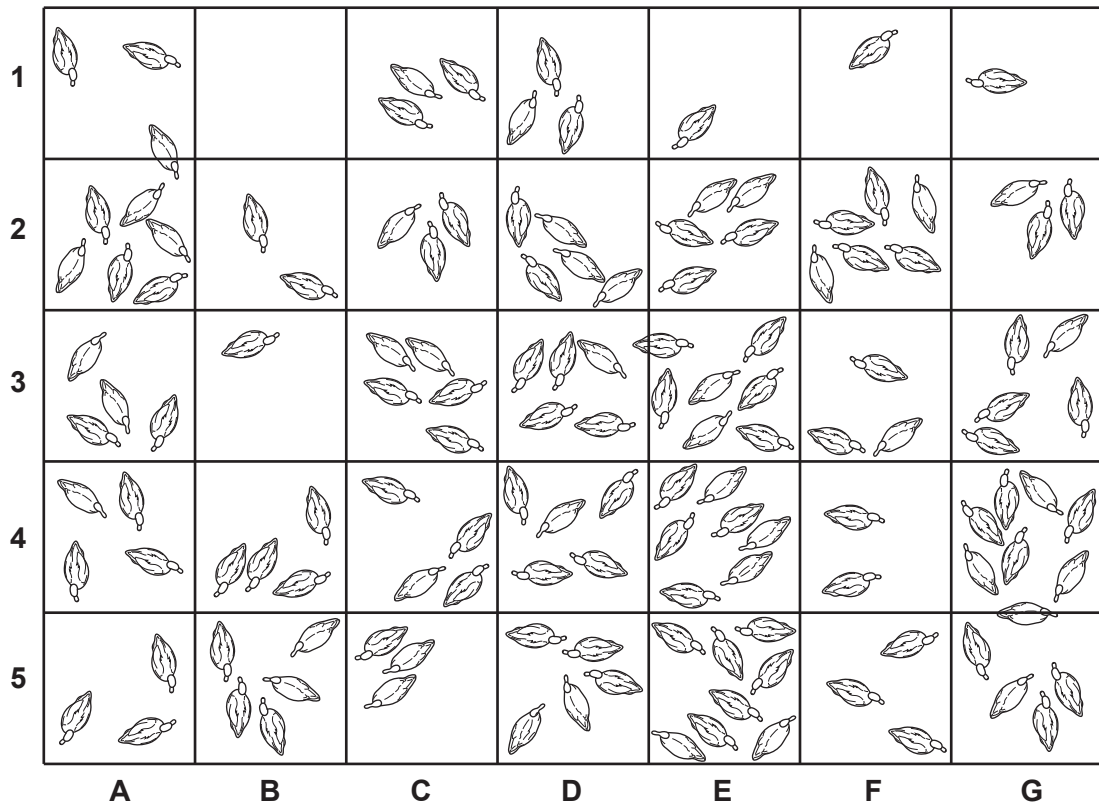


Fig. 3.1

- (i) Complete Table 3.1 to record the number of birds in the grid squares **A4** and **D3**.

Table 3.1

	A	B	C	D	E	F	G
1	3	0	3	3	1	1	1
2	6	2	3	5	5	6	3
3	4	1	5		7	3	5
4		4	4	5	7	2	7
5	3	5	3	5	8	3	5

[2]

- (ii) Describe the benefits and limitations of using aerial photographs to survey the population of birds.

benefits

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limitations

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[4]

- (b) The formula shows Simpson's index of diversity.

$$D = 1 - \left(\sum \left(\frac{n}{N} \right)^2 \right)$$

Simpson's index of diversity is a measure of diversity that takes into account the number of species present and the relative abundance of each species.

The conservationist uses Simpson's index of diversity to analyse data from an aerial photograph in location **X**.

Table 3.2 shows the data from the aerial photograph for location **X**.

Table 3.2

species	$n =$ number of individuals	$\frac{n}{N}$	$\left(\frac{n}{N} \right)^2$
Canada goose	54	0.58	0.34
sandhill crane	12	0.13	0.017
snow goose	26	0.28	0.078
bald eagle	1	0.011	0.00012
$N =$ total number of all individuals	93		

- (i) Use the formula to determine a value for Simpson's index of diversity for location **X**.

Simpson's index of diversity = [2]

- (ii) Simpson's index of diversity for two other locations **Y** and **Z** are shown in Table 3.3.

Table 3.3

location	Simpson's index of diversity
Y	0.66
Z	0.75

Compare the diversity of species in locations **Y** and **Z**.

.....
 [1]

- (c) Fig. 3.2 is a drawing of a sandhill crane.



Fig. 3.2

The adult sandhill crane is 80–136 cm tall and has a wingspan of over 180 cm.

The conservationist wants to monitor the population of sandhill cranes using a capture-mark-recapture method.

- (i) Outline the capture-mark-recapture method the conservationist can use.

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- (ii) State **two** assumptions that must be made when using capture-mark-recapture data.

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[2]

- (d) From late February to early April over 600 000 sandhill cranes fly to the wetlands of Nebraska, in the midwest of the USA. This is called migration.

The birds feed on land or in shallow marshes to fatten up before they continue their migration north to their summer breeding grounds.

Fig. 3.3 shows part of a food web.

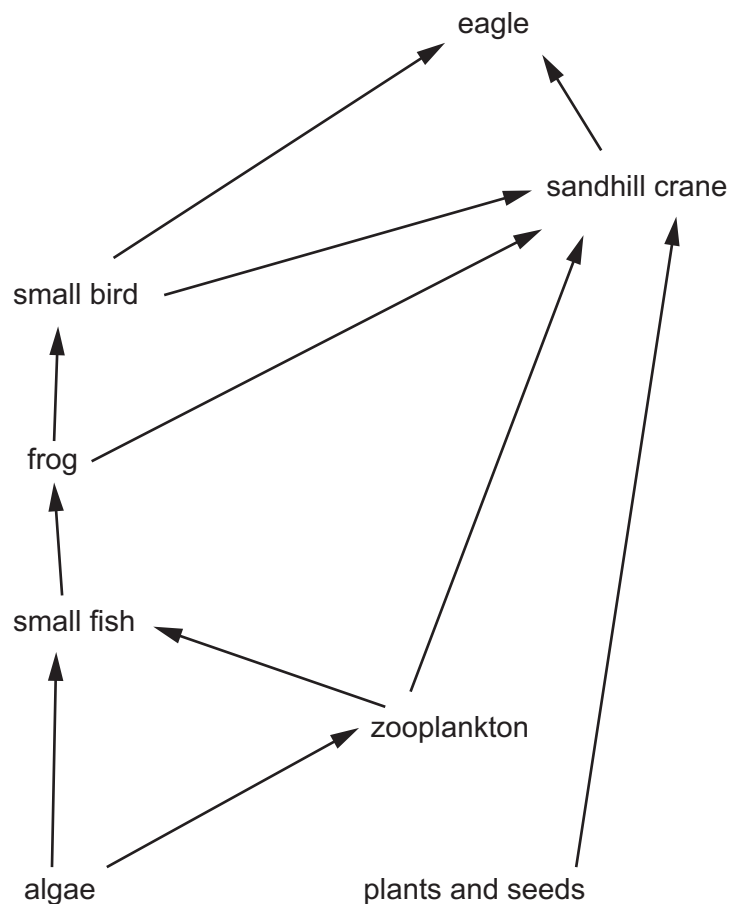


Fig. 3.3

- (i) Identify the maximum number of trophic levels in this food web.

..... [1]

- (ii) Use Fig. 3.3 to write a food chain for the sandhill crane that includes **only** one producer, one primary consumer and one secondary consumer.

..... [1]

- (e) Banning the hunting of sandhill cranes or requiring permits to hunt them helps to conserve the population of sandhill cranes.

Fig. 3.4 shows a sign also used to help conserve the population of sandhill cranes.



Fig. 3.4

Suggest why these three strategies help to conserve the population of sandhill cranes.

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..... [3]

- (f) Climate change is a threat to the sandhill crane.

Suggest why climate change could decrease the population of sandhill cranes. Give reasons for your answer.

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..... [4]

[Total: 23]

- 4 (a) Table 4.1 shows data for total forest cover in Ethiopia from 1990 to 2010. Ethiopia is a country in Africa.

Table 4.1

year	total forest cover/ 1000 ha
1990	15 114
2000	13 705
2005	13 000
2010	12 296

- (i) Calculate the percentage change in total forest cover from 1990 to 2010.

percentage change = [2]

- (ii) Suggest reasons for the decrease in forest cover shown in Table 4.1.

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..... [3]

- (b) A student used a questionnaire to ask farmers in six areas, **A** to **F**, of Ethiopia about their opinion on planting trees in their local area.

Table 4.2 shows the results of the questionnaire.

Table 4.2

Are you in favour of planting more trees on your land?				
area	number of respondents	percentage response		
		yes	no	don't know
A	120	82	15	3
B	100	83	17	0
C	60	93	7	0
D	120	89	10	1
E	5	80	20	0
F	120	94	4	2
average total			12	1

- (i) Complete Table 4.2 to determine the average total percentage responses for yes. [1]
- (ii) Write a suitable conclusion that summarises the main opinion of the farmers on planting more trees on their land.

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..... [1]

- (iii) Describe a sampling strategy to select the farmers to ensure the results of the questionnaire are free from bias.

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..... [3]

- (iv) Suggest limitations with the data in Table 4.2.

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[Total: 12]

- 5 (a) Fig. 5.1 shows data about traffic congestion in four of India's cities.

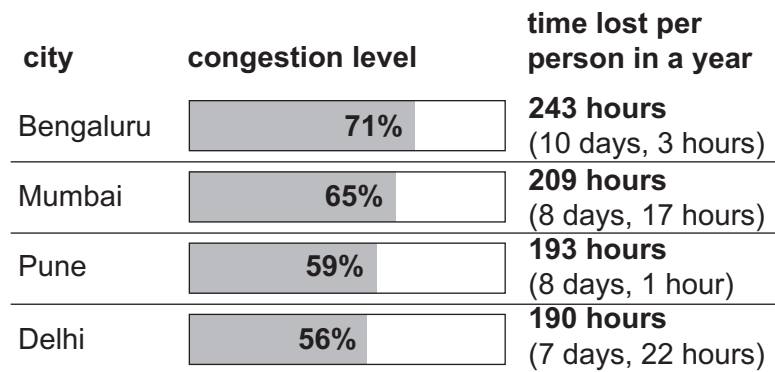


Fig. 5.1

Suggest the impacts of traffic congestion on people living in these four cities.

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Drivers typically earn \$3 per day.

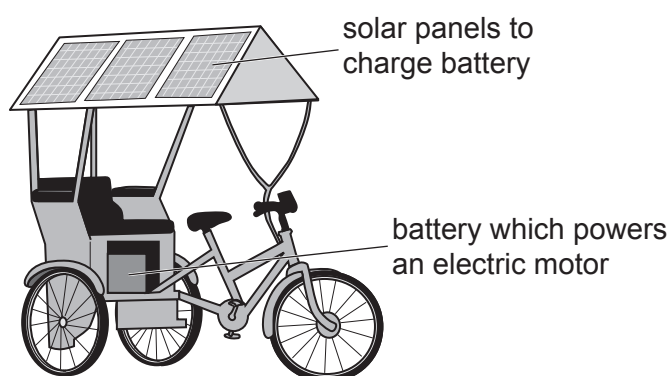


Fig. 5.2

Suggest the benefits and limitations of Soleckshaw in reducing the impacts of traffic congestion in Delhi.

..... [6

[Total: 10]

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