Cambridge Assessment International Education

Cambridge International AS Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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8399143497

ENVIRONMENTAL MANAGEMENT **8291/23**

Paper 2 Management in Context **May/June 2023**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- 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.

INFORMATION

- 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 **20** pages. Any blank pages are indicated.

DC (SM/SG) 328047

[Turn over

1 Plants use chlorophyll to capture light energy for photosynthesis.

(a) State the word equation for photosynthesis.

..... [2]

(b) Chemists have developed a chemical that can be added to the roots of plants to improve the efficiency of photosynthesis. In laboratory studies, the chemical increased crop yield by 20%.

Suggest why increasing crop yield can improve global food security.

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..... [2]

(c) Maize is a food crop.

Table 1.1 shows data for world maize yield in tonnes per hectare for two years.

Table 1.1

year	yield /tonnes per ha
1961	1.94
2018	5.92

Calculate the percentage increase in world maize yield from 1961 to 2018.

.....% [2]

(d) Globally, 1.3 billion tonnes of food are wasted each year.

40% of all foods require refrigeration (cold temperatures) to maintain freshness.

(i) Suggest why countries with low-income economies are less likely to use refrigeration.

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..... [2]

(ii) It is estimated that 15% of fossil fuel energy is used in the global transport of refrigerated food.

Describe **one** strategy to reduce the use of fossil fuels in transporting food.

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..... [2]

(e) Genetically modified (GM) crops can help improve food security.

(i) 'Roundup Ready' soya is a GM crop grown in North and South America. This GM crop allows farmers to spray soya plants with herbicide. The GM crop is **not** harmed by herbicides.

Suggest the benefits and limitations of using herbicide-resistant GM crops, such as 'Roundup Ready' soya.

benefits .....

.....

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limitations .....

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[4]

(ii) GM crops are being developed to have lighter and brighter coloured leaves than other crops. The lighter and brighter leaves increase the overall albedo of the plant.

Explain how increased albedo can help to counteract climate change.

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..... [2]

[Total: 16]

2 Fig. 2.1 shows the African clawed frog and tadpole. The frog is native to Africa.

1–5 cm
tadpole

5–12 cm
mature frog

Fig. 2.1

The female African clawed frog typically lays between 500–2000 eggs at a time. Fertilised eggs hatch into tadpoles and the tadpoles change into frogs.

(a) A researcher investigated the effect of artificial light on the African clawed frog.

The researcher collected samples of fertilised eggs from five different female frogs, **A**, **B**, **C**, **D** and **E**.

Artificial light was used on each sample for a different number of hours per day for 8 weeks. The number of adult frogs after 8 weeks was counted.

The investigation was repeated with a different egg sample from the same five female frogs.

The results are shown in Table 2.1.

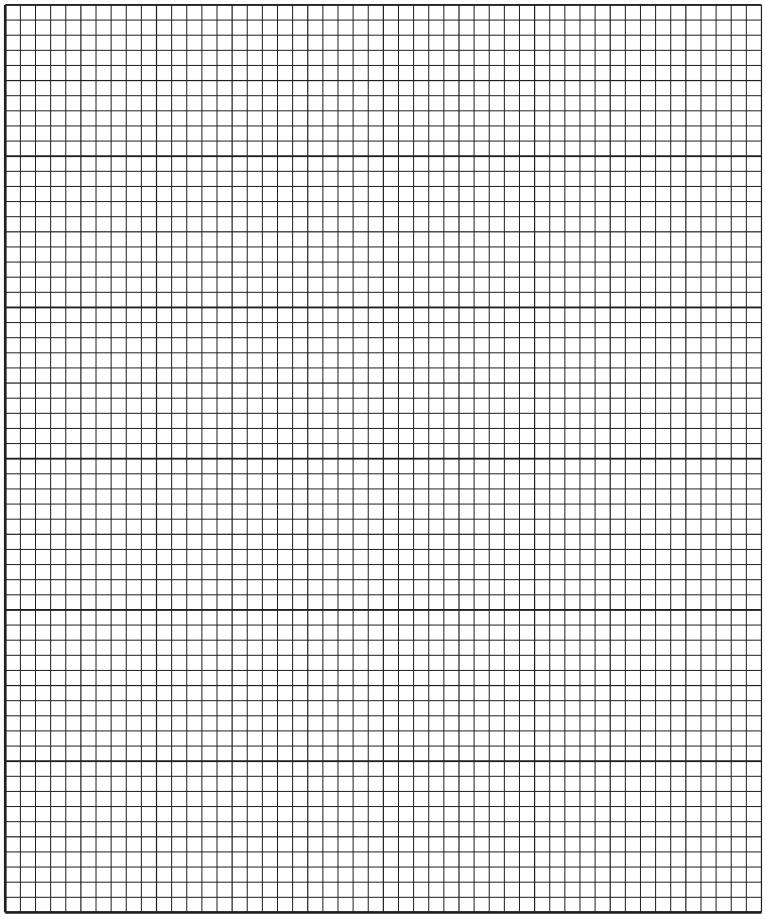
Table 2.1

frog	**artificial light / hours per day**	**number of adult frogs**		
		investigation 1	investigation 2	mean
A	0	205	307	256
B	4	198	3	198
C	8	200	250	225
D	16	105	111	108
E	24	83	89	86

(i) Calculate the range for the number of adult frogs from frog **D**.

range = ... [1]

(ii) Plot a bar chart of the mean number of adult frogs (*y*-axis) against the hours of artificial light per day.



[4]

(iii) Suggest a reason why the result for frog **B** in investigation 2 was **not** included in the mean.

.....

..... [1]

(iv) Use the data in Table 2.1 to write a suitable conclusion for the investigation.

.....

..... [1]

(v) Describe **one** limitation of the method of egg sampling used in this investigation.

.....

..... [1]

[Turn over

(b) Fig. 2.2 shows a 20 m tape fixed along the edge of a pond.

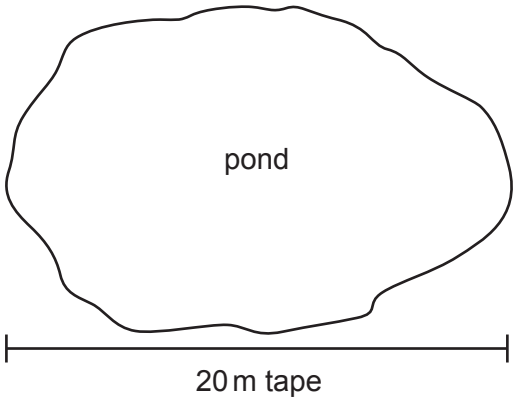


Fig. 2.2

Describe a suitable quadrat method for collecting data on the population of the African clawed frog along the 20 m tape using an open quadrat.

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..... [4]

(c) Water was collected from the pond at six sample sites and the salinity measured at each site. The salinity is recorded as the salt concentration in parts per million (ppm).

Fig. 2.3 shows the location of the six sample sites.

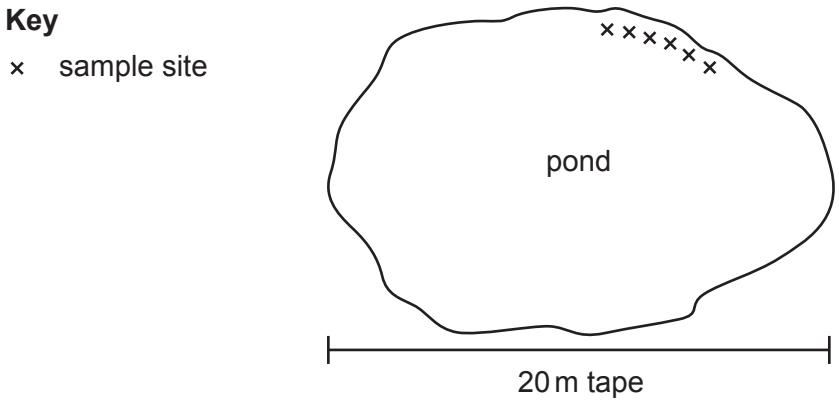

Fig. 2.3

(i) Suggest **one** limitation of the location of the sample sites.

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..... [1]

(ii) Table 2.2 shows the salt concentrations from the six sample sites at the pond.

Table 2.2

sample site	salt concentration / ppm
1	252
2	300
3	321
4	257
5	281
6	314

Calculate the mean salt concentration for the six sample sites.

Give your answer to the nearest whole number.

mean salt concentration = ... ppm [1]

(d) Suggest reasons why the African clawed frog has become an invasive species in some locations.

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..... [2]

(e) Salinity is one abiotic component of an ecosystem.

State **one** other abiotic component.

..... [1]

(f) A food chain for the African clawed frog is shown.

grass → grasshopper → African clawed frog → snake

(i) Identify the tertiary consumer in this food chain.

..... [1]

(ii) Identify which trophic level will be affected the **most** by biomagnification.

..... [1]

(iii) Suggest the short-term effect on the population of grasshoppers if the number of African clawed frogs increases.

Give a reason for your answer.

effect .....

reason .....

.....

[1]

[Total: 20]

3 Fig. 3.1 shows a leatherback turtle.

Fig. 3.1

(a) Fig. 3.2 shows the location of three populations of leatherback turtles.

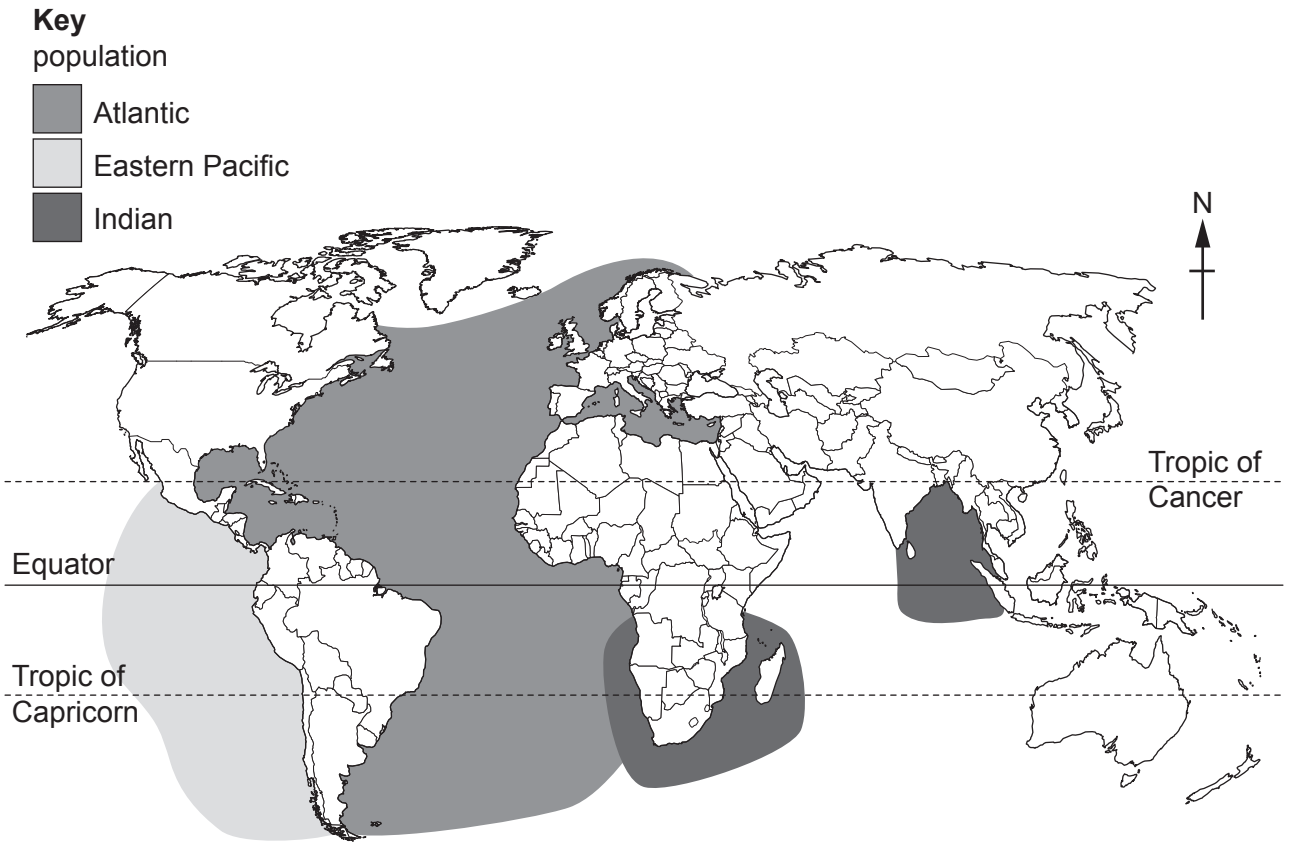

Fig. 3.2

Use Fig. 3.2 to describe the location of the population of **Eastern Pacific** leatherback turtles.

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..... [2]

(b) Fig. 3.3 shows the mean number of turtle nests for two populations of leatherback turtles.

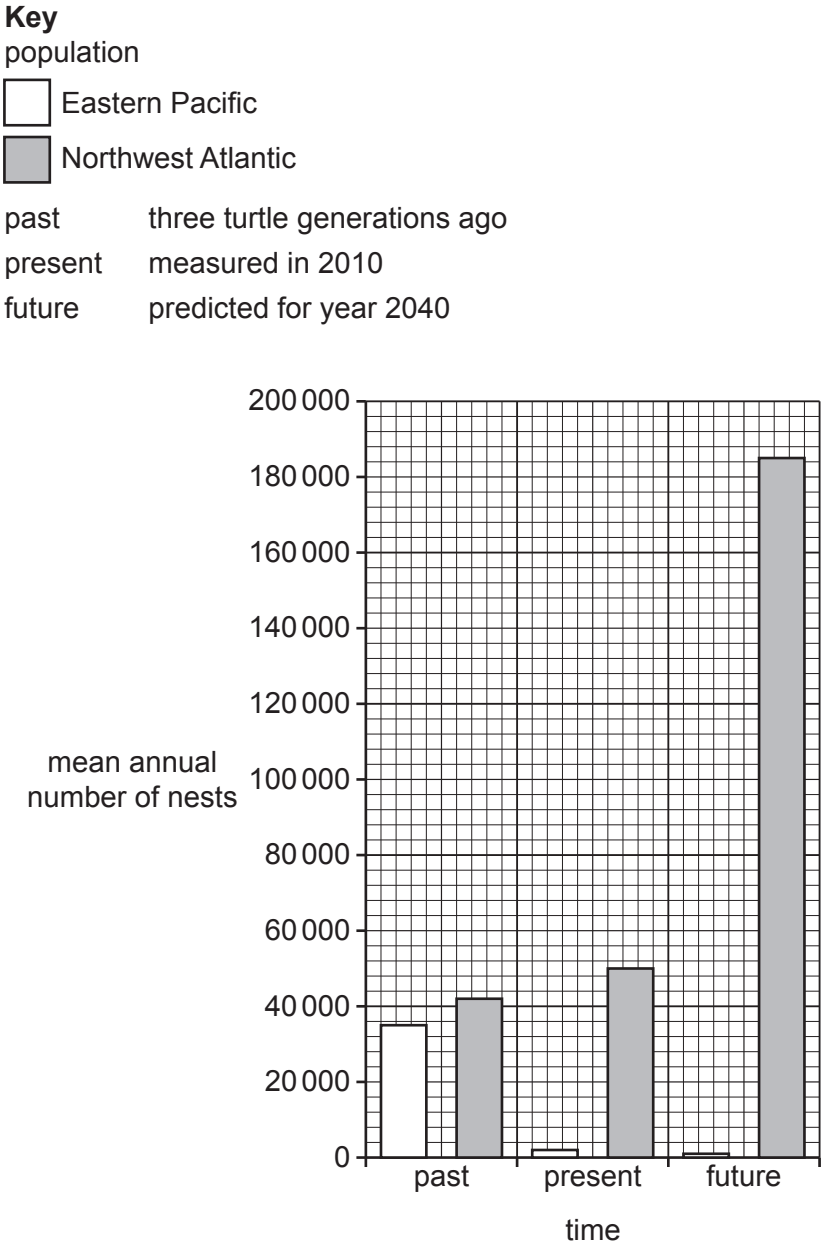

Fig. 3.3

Use Fig. 3.3 to compare the two populations of leatherback turtles.

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..... [2]

(c) Climate change is a major threat to leatherback turtles.

Higher sand temperature during egg incubation leads to a higher number of female turtles.

(i) Explain why higher sand temperature can be a result of climate change.

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..... [2]

(ii) Suggest the impact higher sand temperature has on the population of turtles.

Give reasons for your answer.

impact .....

reasons .....

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[2]

(iii) Suggest **one** other impact of climate change that could decrease the population of turtles.

Give a reason for your answer.

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..... [2]

(iv) Fig. 3.4 shows a turtle caught in a fishing net.

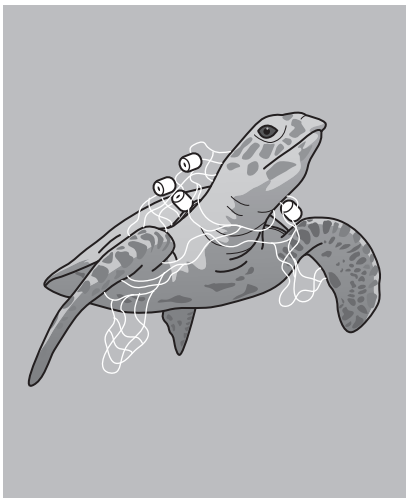

Fig. 3.4

One conservation strategy for protecting turtles is reducing the accidental catch of turtles in fishing nets.

Suggest how the accidental catch of turtles in fishing nets can be prevented.

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..... [1]

(d) Captive breeding and release is another method of conserving the population of turtles.

Outline the benefits and limitations of captive breeding and release.

benefits .....

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limitations .....

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[4]

[Total: 15]

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4 **(a)** CFCs such as CFC-12 are **not** used in new equipment because of their ozone depletion potential.

(i) Outline how CFCs cause ozone depletion.

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..... [5]

(ii) Explain the meaning of the term ozone hole.

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..... [2]

(b) Global warming potential (GWP) is a measure of the climate warming effect of a chemical compared to carbon dioxide.

Carbon dioxide has a GWP of 1.

Table 4.1 shows the GWP for chemicals used in aerosols.

Table 4.1

chemical		**GWP**
CFC	CFC-12	10900
alternative to CFCs	HFC-134a	1430
	N_2O (an oxide of nitrogen)	298
	HFC-152a	124
	HFO-1234ze(E)	6

(i) Alternatives to CFCs were introduced to limit ozone depletion.

Suggest **other** impacts associated with the use of some alternatives to CFCs.

Use data from Table 4.1 to support your answer.

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..... [4]

(ii) The use of CFCs was gradually phased out.

Suggest reasons why a complete ban was **not** immediately introduced as soon as the evidence for their role in ozone depletion was understood.

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..... [3]

[Total: 14]

5 It is estimated that air pollution kills seven million people per year.

(a) Particulate matter that is less than 2.5 μm in diameter is called PM2.5.

Fig. 5.1 shows an air quality map for PM2.5 in Africa. The higher the number, the greater the concentration of PM2.5.

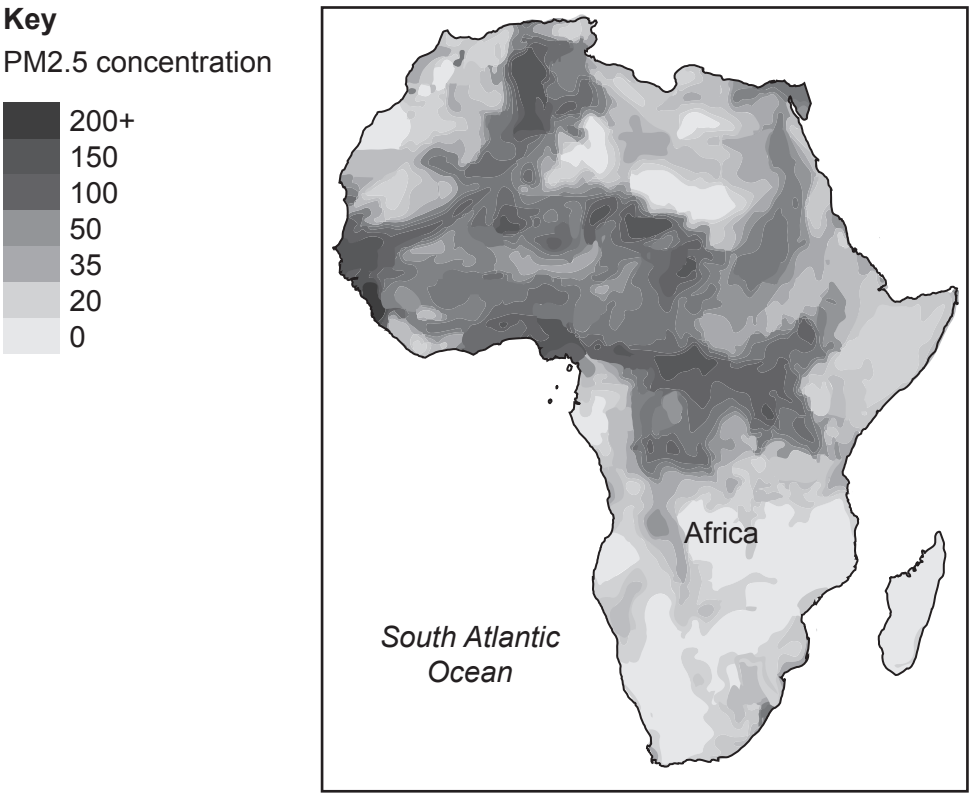

Fig. 5.1

(i) Suggest reasons why some areas of Africa have a higher concentration of PM2.5 than other areas.

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..... [3]

(ii) A report stated that there are 50 permanent PM2.5 monitoring stations in Africa and 1000 in Europe.

Suggest **one** reason for this difference in monitoring.

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..... [1]

(b) ‘Pigeon air patrol’ is one strategy used to combat air pollution.

Fig. 5.2 shows one of the birds used in the ‘pigeon air patrol’.

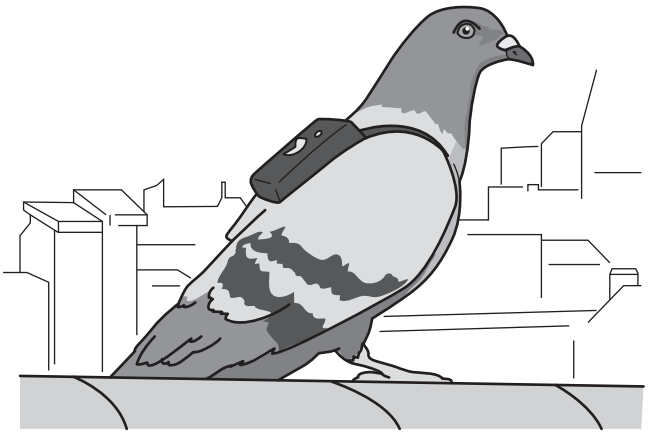

Fig. 5.2

Ten pigeons were fitted with portable air pollution monitors that measured concentrations of nitrogen dioxide, ozone and volatile organic compounds.

The birds were released at the times when people were travelling to and from work.

The results are immediately shared on social media and the internet.

Suggest the benefits and limitations of this type of air pollution monitoring.

benefits .....

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limitations .....

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[4]

(c) Volatile organic compounds (VOCs) contribute to photochemical smog.

(i) Define photochemical smog.

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..... [2]

(ii) Photochemical smog harms health.

State **two** non-health related impacts of photochemical smog.

1 .....

2 .....
[2]

(iii) Describe how emissions of VOCs can be reduced.

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..... [3]

[Total: 15]

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