



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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8291/22

October/November 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 **20** pages. Any blank pages are indicated.

- 1 Fig. 1.1 is a map of Mongolia. Mongolia has a total land area of 1 560 000 km².



Key

- ★ capital
- international boundary

Fig. 1.1

In 2020, the population of Mongolia was 3 170 000.

(a) Mongolia has a low population density.

(i) Calculate the population density for Mongolia in 2020.

..... people km⁻² [1]

- (ii) Explain the challenges faced by countries with a low population density.

.....

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..... [4]

(b) Fig. 1.2 shows the age dependency ratio in Mongolia from 1960 to 2018.

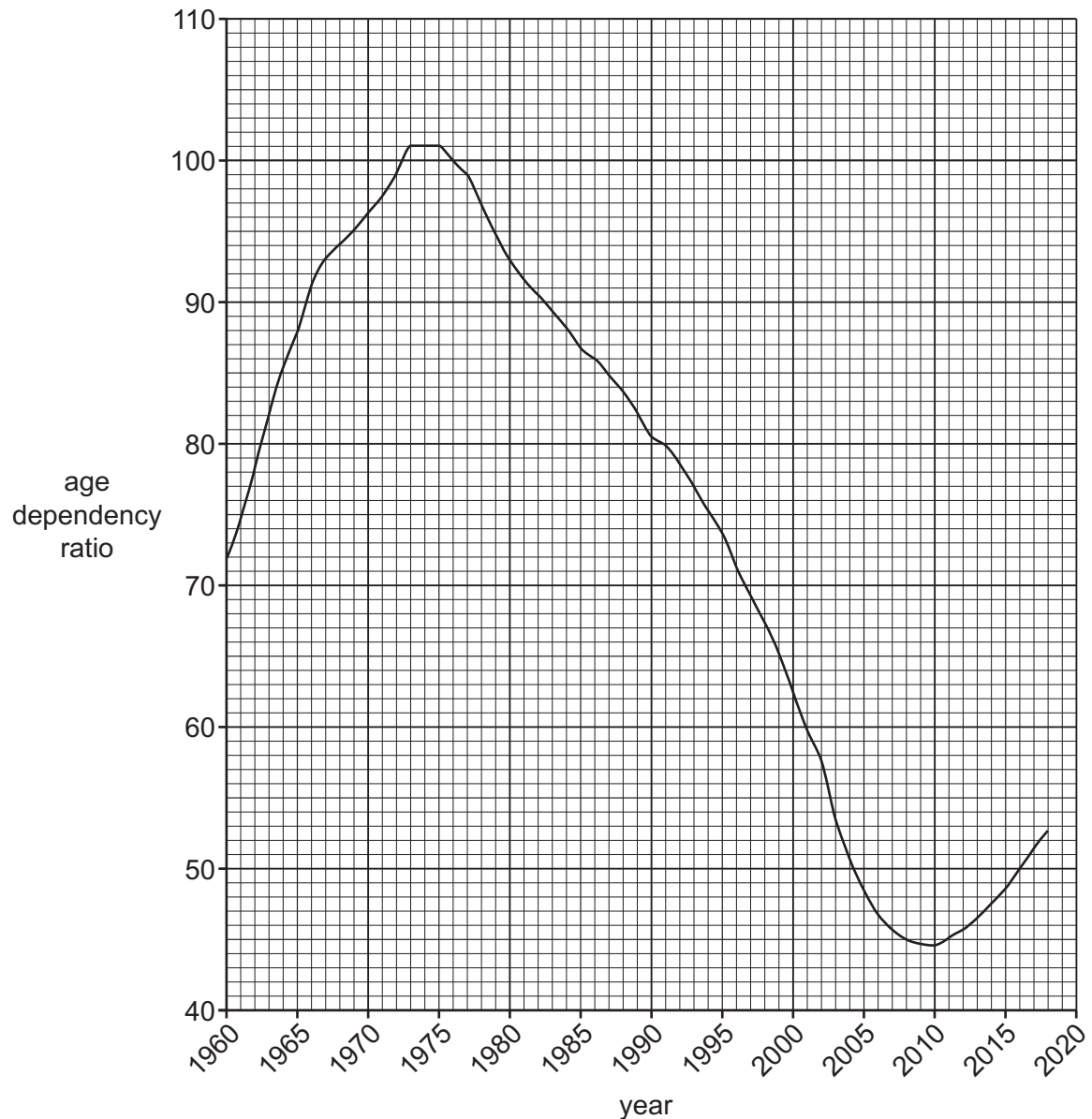


Fig. 1.2

The higher the ratio, the larger the dependent population compared to the working-age population.

A ratio of 100 indicates that the number of dependents is exactly the same as the number of working-age people.

Describe the trend shown by the data in Fig. 1.2.

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[3]

(c) Fig. 1.3 shows the population pyramid for Mongolia in 2020.

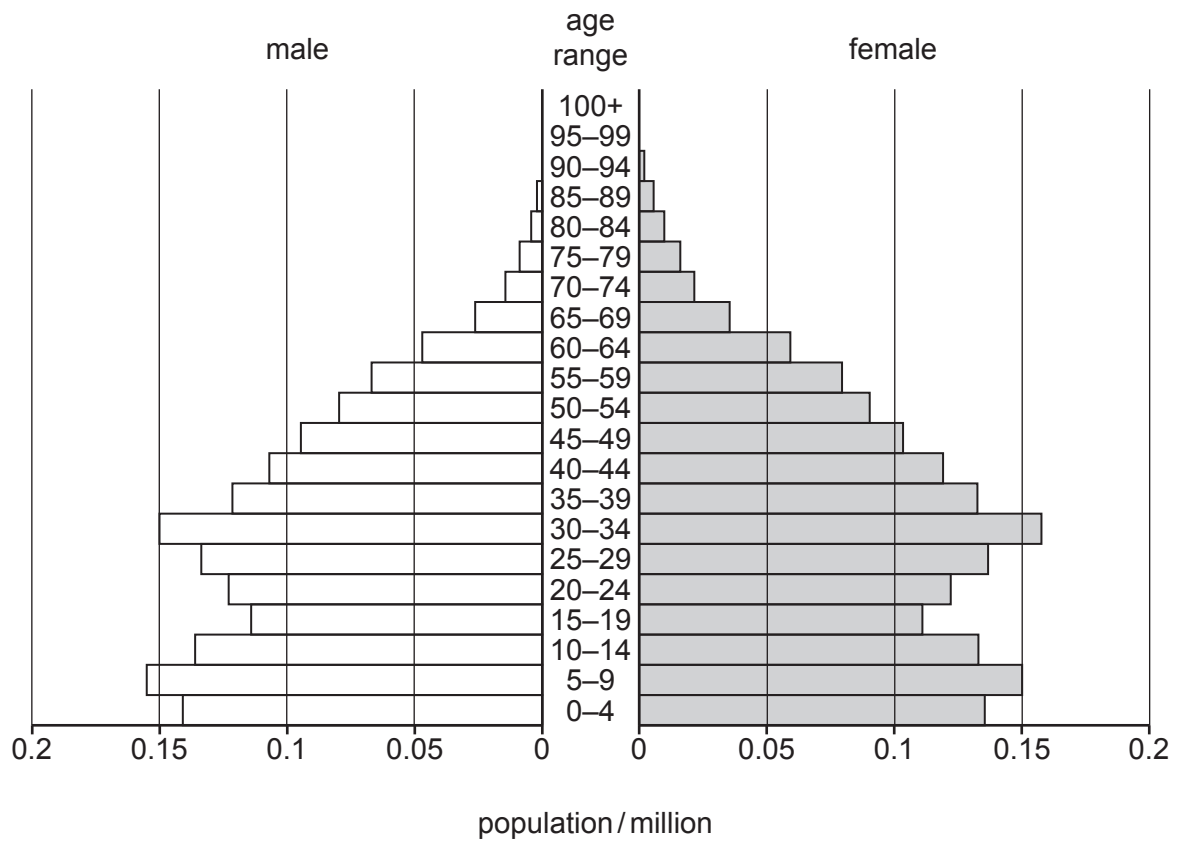


Fig. 1.3

Suggest how the shape of the population pyramid for Mongolia in 1975 was different from the 2020 shape.

Give reasons for your answer.

.....

.....

.....

..... [2]

- (d) The Gobi Desert in Mongolia is a cold desert.

Describe the climate of a cold desert biome in winter and in summer.

winter

.....

summer

.....

[3]

- (e) The photograph in Fig. 1.4 shows an area of desert during primary succession.



Fig. 1.4

- (i) Suggest how the pioneer species in Fig. 1.4 colonised this area of desert.

.....

.....

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..... [2]

- (ii) Suggest the characteristics of the pioneer species in Fig. 1.4.

.....

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..... [2]

- (iii) Explain how the death of pioneer species can lead to secondary succession.

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.....

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..... [2]

- (f) The total area of land in Mongolia is $1\,560\,000\text{ km}^2$. The area of this land covered by water in Mongolia is $10\,560\text{ km}^2$.

- (i) Calculate the percentage of land area covered by water in Mongolia.

percentage = [1]

- (ii) Suggest why climate change can increase water insecurity in Mongolia.

.....

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.....

..... [2]

(iii) Explain the impacts of water insecurity.

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..... [4]

(g) Solar radiation management (SRM) is a theoretical strategy to reduce the impact of climate change.

(i) One SRM strategy is the use of space reflectors.

Outline how space reflectors could reduce the impact of climate change.

.....

.....

.....

..... [2]

(ii) Suggest why some people think investing in SRM technology is more important than reducing our combustion of fossil fuels.

.....

..... [1]

[Total: 29]

- 2 (a) The photograph in Fig. 2.1 shows an area of forested land that has been cleared.



Fig. 2.1

- (i) Suggest reasons for the land clearance in Fig. 2.1.

.....

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..... [2]

- (ii) Some trees have been replanted in this area. Many of the trees are non-native species. Explain the impacts of introducing non-native plant species to an area.

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..... [3]

(b) The bar chart in Fig. 2.2 shows the global loss in tropical tree cover from 2002 to 2018.

loss in
tropical tree
cover/
million ha

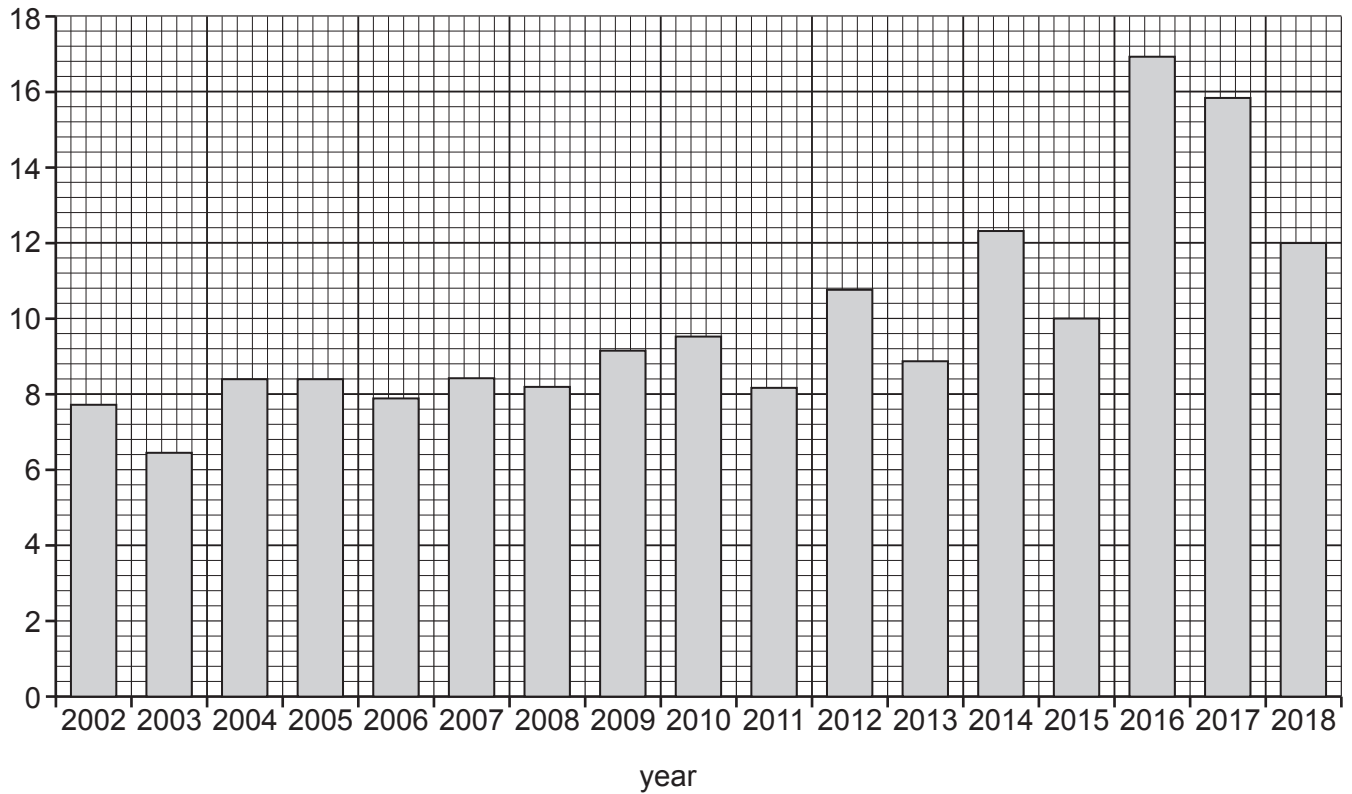


Fig. 2.2

- (i) State what the data in Fig. 2.2 indicates about the area of land covered by tropical forest from 2002 to 2016.

.....
 [1]

- (ii) Use Fig. 2.2 to calculate the percentage change in the global loss in tropical tree cover from 2017 to 2018.

percentage change = [2]

- (iii) Suggest a reason for the percentage change from 2017 to 2018.

.....
 [1]

(c) Explain the benefits of afforestation.

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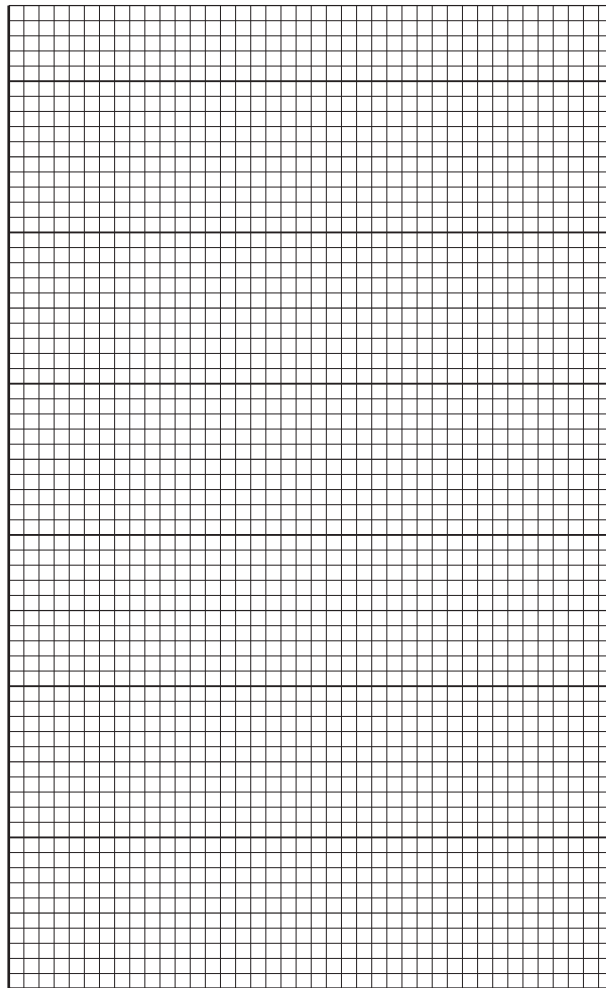
..... [4]

- (d) Table 2.2 shows data for the number of wild fires in one area of the Amazon rainforest from 2013 to 2019.

Table 2.2

	year						
	2013	2014	2015	2016	2017	2018	2019
number of wild fires	3800	9350	8750	8700	10 900	4050	10 750

- (i) Plot the data as a bar chart.



[4]

- (ii) Use Table 2.2 to calculate the average number of wild fires from 2013 to 2019 in this area of the Amazon rainforest.

Give your answer to the nearest whole number.

..... [2]

(iii) Fig. 2.3 shows the distribution of actively burning wild fires on one day in February 2020.

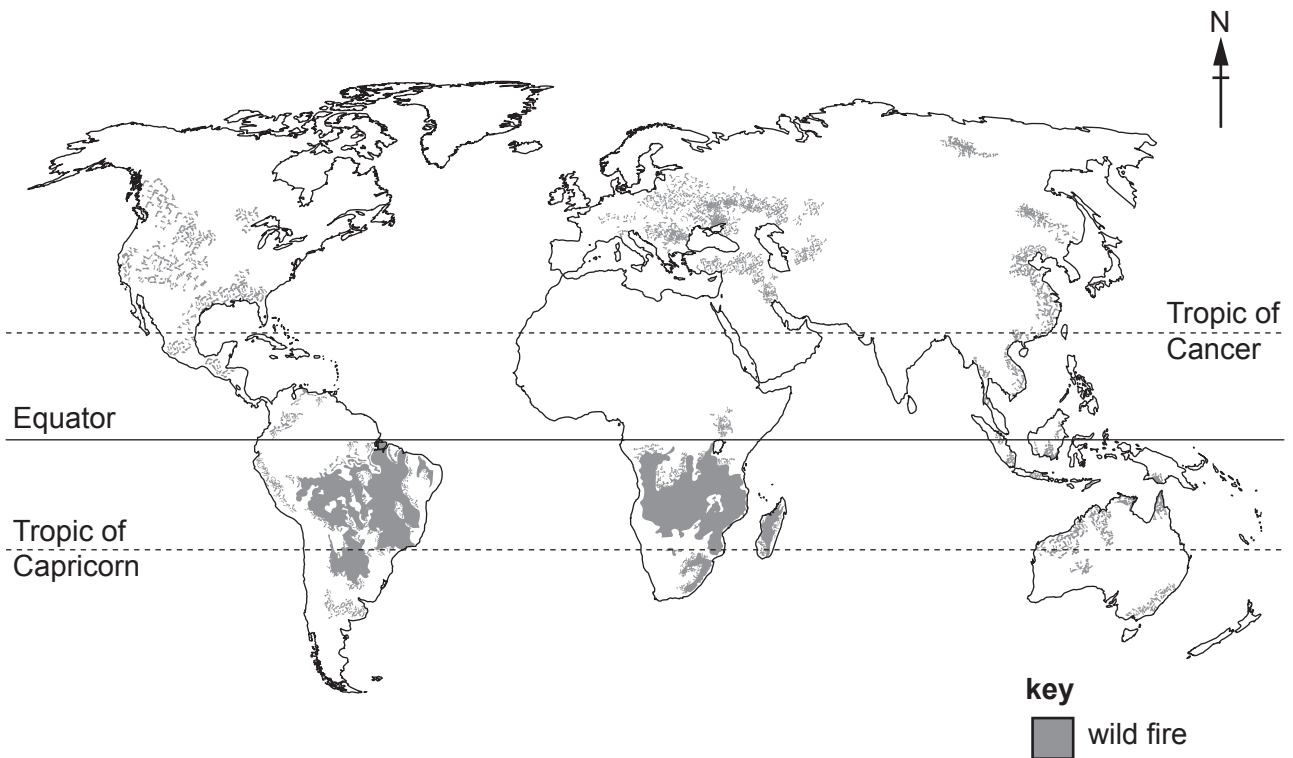


Fig. 2.3

Describe the distribution of actively burning wild fires in Fig. 2.3.

.....

.....

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..... [3]

(iv) Suggest reasons why the number of global wild fires is increasing.

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..... [3]

[Total: 25]

[Turn over

- 3** A biologist wants to investigate the biodiversity in a stream using a kick sampling method.

Fig. 3.1 is a field sketch of the stream.

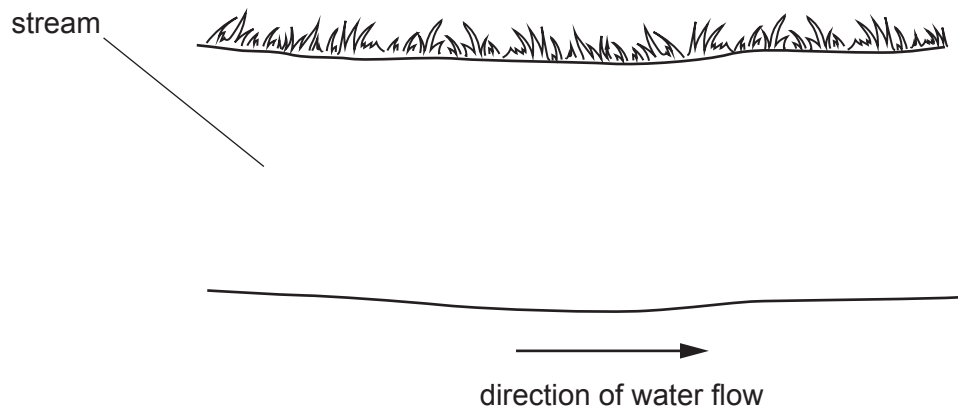


Fig. 3.1

- (a)** Describe a suitable kick sampling method the biologist can use.

You can add to the sketch of the stream to support your answer.

[5]

- (b)** Table 3.1 shows the data from the kick sampling.

Table 3.1

species	n = number of individuals	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$
hairworm	6	0.10	0.010
fly larvae	14	0.24	0.056
pond snail	32		0.29
leech	7	0.12	
N = total number of individuals	59		

The biologist uses Simpson's index of diversity to analyse data from the kick sampling.

- (i) Use Table 3.1 to calculate $\frac{n}{N}$ for the pond snail.

$$\frac{n}{N} = \dots\dots\dots [1]$$

- (ii) Calculate $\left(\frac{n}{N}\right)^2$ for the leech.

Give your answer to two significant figures.

$$\left(\frac{n}{N}\right)^2 = \dots\dots\dots [2]$$

- (iii) Simpson's index of diversity for the stream is shown in Table 3.2.

Table 3.2

year	Simpson's index of diversity
2019	0.66
2020	0.82

The biologist is concerned that the pH of the water in the stream has decreased since 2019.

Discuss whether the data in Table 3.2 supports the biologist's concern.

Give reasons for your answer.

.....

 [2]

- (iv) Suggest causes for a decrease in pH in water bodies.

.....

 [2]

[Total: 12]

- 4 Approximately 623 million people practise open defecation. This is going to the toilet outside in fields, water bodies and open spaces.

(a) Suggest why urbanisation makes open defecation more of a problem.

.....

.....

.....

.....

.....

..... [3]

(b) Fig. 4.1 shows a Tiger Worm Toilet, TWT.

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Fig. 4.1

A TWT contains tiger worms that digest the faeces (toilet waste). Tiger worms eat the equivalent of their own body weight each day.

Fig. 4.2 shows a tiger worm.

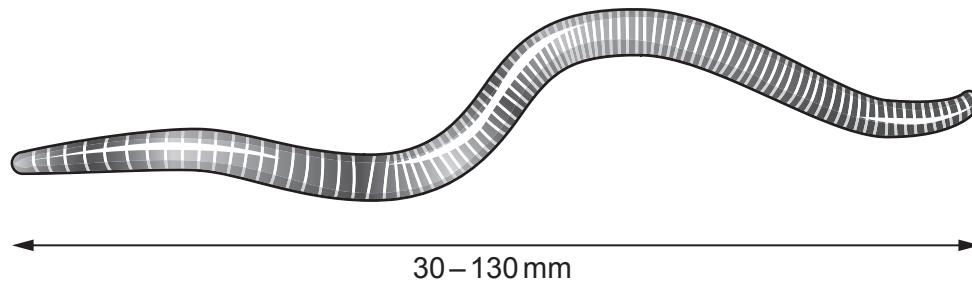


Fig. 4.2

- (i) Tiger worms digest faeces.

Name this type of feeding relationship.

..... [1]

- (ii) The wood chip bedding layer in the TWT must be kept moist to enable the worms to digest the faeces aerobically.

Users of the TWT are required to flush the toilet with a cup of water after each use. The wood chip bedding layer must **not** become flooded.

Suggest why these requirements of the TWT limit its use in some locations.

.....

 [2]

- (iii) Suggest why chemical cleaning products must **not** be used to clean a TWT.

.....
 [1]

- (c) The authorities in a rural community want to build more TWTs for the local people.

They use a questionnaire to find out local people's opinions on TWTs.

- (i) Describe a sampling method for selecting the local people for the questionnaire that reduces bias.

.....

.....

.....

..... [2]

- (ii) The authorities consider two types of questions for the questionnaire.

type 1: questions require a yes or no answer only

type 2: questions allow people to write their own answers

Outline **one** benefit and **one** limitation with type 1 questions compared with type 2 questions.

benefit of type 1

.....

limitation of type 1

.....

[2]

- (iii) Table 4.1 shows part of the questionnaire used to find out local people's opinions on TWTs.

Table 4.1

date:	location:	
question	response	
	yes	no
Do you use a TWT?		
.....		
.....		
.....		

In Table 4.1, write **one** other suitable question for this questionnaire.

[1]

(d) Fig. 4.3 shows a pit toilet.

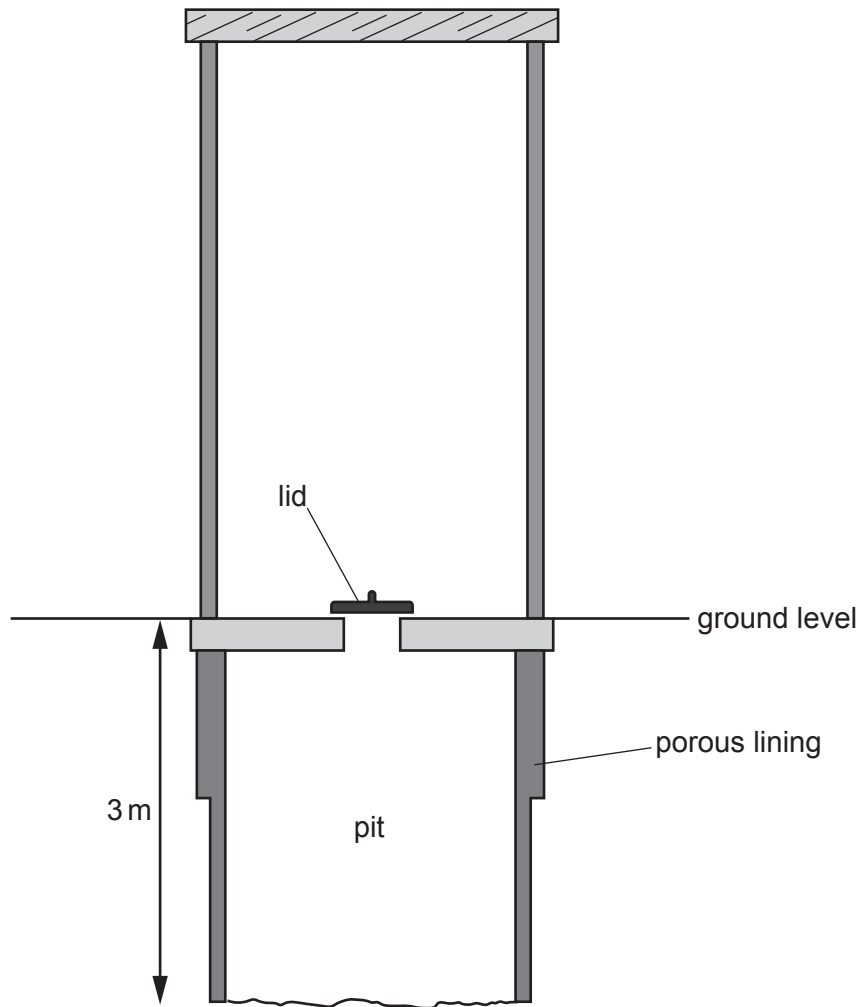


Fig. 4.3

Pit toilets are alternatives to TWT toilets. Once the pit is full of faeces, the pit toilet is moved to a new location.

Outline **one** advantage and **one** disadvantage of a pit toilet compared with a TWT.

advantage

.....

disadvantage

.....

[2]

[Total: 14]

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