



CANDIDATE
NAME

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CENTRE
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NUMBER

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8291/21

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

- 1 (a) In 2020, 83% of homes in the United Kingdom combusted natural gas (methane) for heating.

In January 2020, a blend of 20% hydrogen gas and 80% natural gas was trialled in 100 homes. The trial cost more than \$9 million.

When hydrogen is combusted, it generates heat and water.

It is estimated that switching to 100% hydrogen gas will save 6 million tonnes of carbon dioxide per year from being emitted into the atmosphere.

- (i) Explain why alternative fuels to methane are needed.

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..... [3]

- (ii) Suggest **two** reasons why the trial to replace methane might **not** be extended to the whole of the United Kingdom.

1

.....

2

..... [2]

- (iii) Hydrogen can be obtained from methane. This process emits carbon dioxide.

State **two** strategies for removing carbon dioxide once it is in the atmosphere.

1

.....

2

..... [2]

- (b) Fig. 1.1 shows fossil fuel consumption as a percentage of total energy consumption for high-income economy countries (HICs) and low-income economy countries (LICs) between 1970 and 2015.

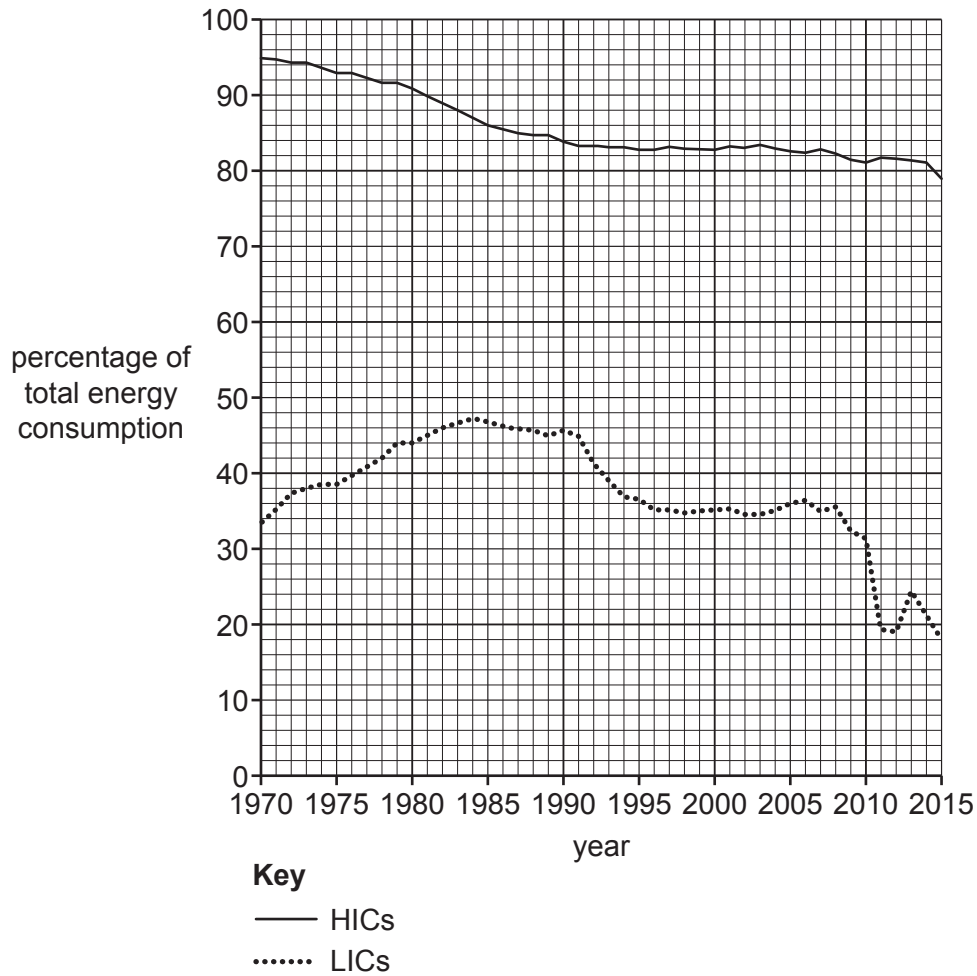


Fig. 1.1

- (i) Compare the trends shown in fossil fuel consumption for HICs and LICs shown in Fig. 1.1.

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..... [4]

- (ii) Some countries do **not** have a supply of fossil fuels. They have to import fossil fuels into their country.

Explain how this can lead to energy insecurity.

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..... [2]

[Total: 13]

- 2 (a) Fig. 2.1 shows the mass of waste generated per person in seven countries in Europe in 2016.

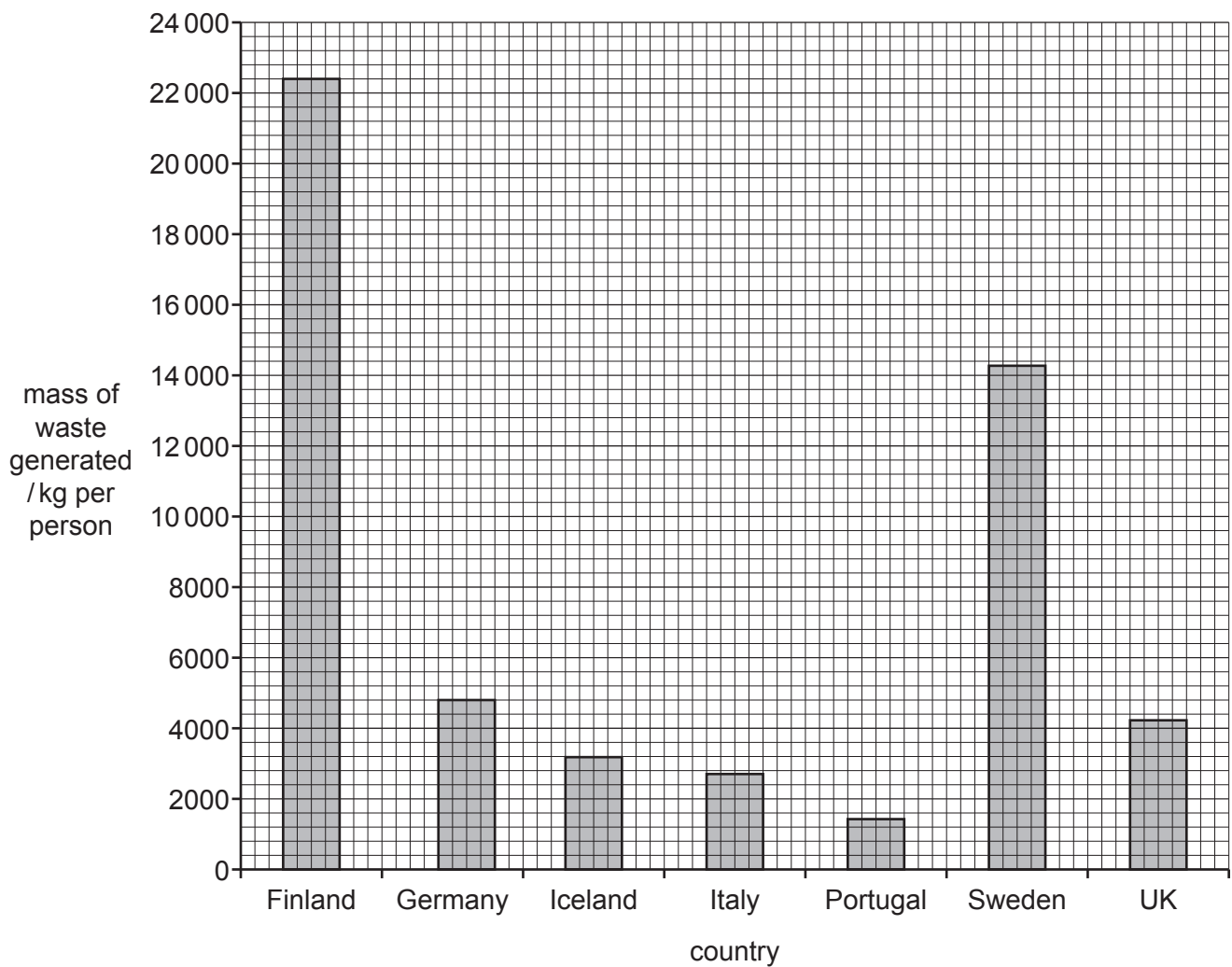


Fig. 2.1

- (i) The average mass of waste generated per person in Europe is 5000 kg.

State the number of the countries shown in Fig. 2.1 that generated more than this value.

..... [1]

- (ii) A report stated that in 2016 Germany recycled 65% and Finland recycled 40% of the waste they generated.

Use Fig. 2.1 to calculate:

- the mass of waste recycled in Germany in 2016

..... kg per person

- the mass of waste **not** recycled in Finland in 2016.

..... kg per person

[2]

- (iii) State **two** strategies to increase the percentage of waste that is recycled in a country.

1

2

[2]

- (iv) Incineration is used to dispose of waste.

Suggest benefits and negative impacts of waste incineration.

benefits

.....

.....

.....

negative impacts

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[4]

- (v) In 2019, more than 1.8 million tonnes of plastic waste were exported from Europe as a waste disposal strategy. Most of this plastic waste went to China and Hong Kong.

Evaluate the impacts of this waste disposal strategy.

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..... [4]

- (b) Fig. 2.2 shows a penguin colony in Antarctica.



Fig. 2.2

The Antarctic Treaty is an international agreement that protects the Antarctic. Some of the treaty's aims include:

- protection of the Antarctic environment
- conservation of plants and animals
- management of tourism
- management of protected areas.

- (i) All waste, other than sewage and food waste, is removed from Antarctica.

Suggest why sewage and food waste are **not** removed from Antarctica.

.....
 [1]

- (ii) Suggest why all other waste is removed from Antarctica.

.....

 [2]

- (c) Approximately 30 000 tourists visit Antarctica each year.

Describe how tourism can be controlled in protected environments such as Antarctica.

.....

 [3]

[Total: 19]

- 3 (a) Light pollution is caused by the use of artificial light. Light pollution has been linked to a rapid decrease in insect populations.

(i) Suggest why the use of artificial light is increasing.

.....
 [1]

(ii) Suggest why a decrease in insect populations is of global concern.

.....

 [2]

- (b) The corn earworm moth is a species of insect affected by light pollution. The moth will not reproduce if light levels are too high.

Fig. 3.1 shows the corn earworm larva and Fig. 3.2 shows the corn earworm moth.

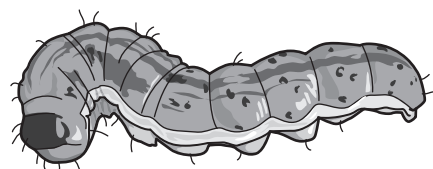


Fig. 3.1

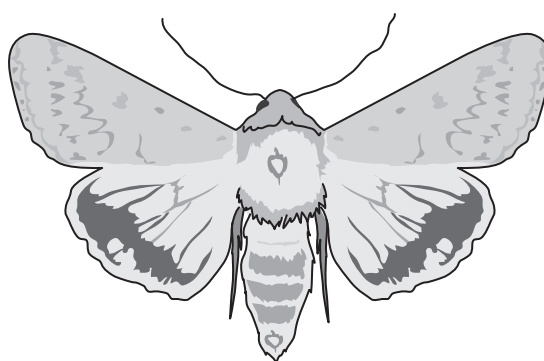


Fig. 3.2

The corn earworm larvae are a pest of corn, cotton, tomato and tobacco plants.

A farmer uses a light trap to investigate the population of corn earworm moths in three fields, **A**, **B** and **C**.

Each field is sampled for three weeks. The number of corn earworm moths collected each week for three weeks is recorded.

The results are shown in Table 3.1.

Table 3.1

		field A	field B	field C
number of corn earworm moths collected	week 1	16	7	250
	week 2	17	3	235
	week 3	15	2	265
	average	16	4	

- (i) Complete Table 3.1 by calculating the mean (average) number of corn earworm moths collected in field C. [1]
- (ii) The farmer uses the data in Table 3.2 to decide whether to spray the fields with insecticide.

Table 3.2

average weekly number of corn earworm moths	spray frequency
> 350	every 3 days
11–349	every 4 days
5–10	every 5 days
< 5	no spray

Use the data to suggest the spray frequency for fields **A** and **B**.

field **A**

field **B**

[2]

- (iii) Describe **two** agricultural techniques that control crop pests, other than using insecticide.

1

.....

2

.....

[2]

- (iv) The farmer selected the three fields out of 50 possible fields for this investigation.

Describe a sampling strategy to select the three fields to ensure the investigation is free from bias.

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..... [3]

- (v) A sweep net is a way of collecting insects.

Describe the benefits and limitations of using a sweep net to collect insects.

benefits

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limitations

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..... [4]

[Total: 15]

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- 4 In 2020, Ethiopia, a country in Africa, had 15% of its land covered by forest. Fifty years ago, 40% of Ethiopia was covered by forest.

(a) (i) Suggest how the percentage forest cover for a country can be measured.

.....
 [1]

(ii) Explain how deforestation reduces biodiversity.

.....

 [2]

- (b) A student used a questionnaire to ask some people in Ethiopia for their opinion on how forest cover has changed in their local area.

Table 4.1 shows the results of the questionnaire.

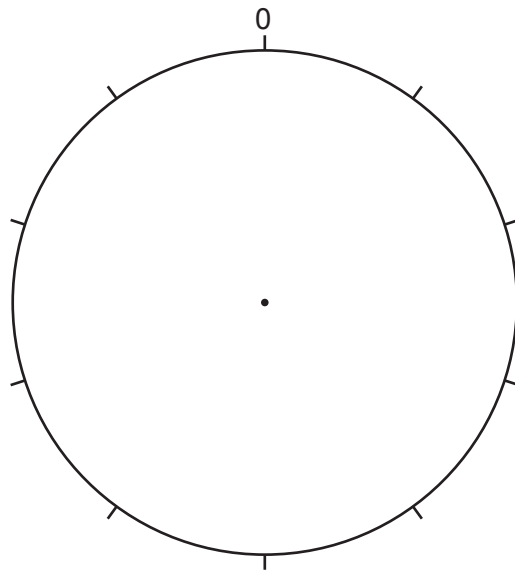
Table 4.1

percentage response				
rapidly decreasing	gradually decreasing	same as before	increasing	no opinion
50	30	10	7	3

- (i) Write a suitable conclusion that summarises the main opinion on how forest cover has changed in Ethiopia.

.....
 [1]

- (ii) Draw a pie chart of the data in Table 4.1. Complete the key.



Key

☐

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☐

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☐

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☐

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☐

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[3]

- (iii) Suggest **one** piece of additional information that is needed to ensure the data in Table 4.1 is reliable.

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..... [1]

(c) In 2019, a major reforestation programme took place in Ethiopia.

350 million trees were planted over a 12-hour period in July.

(i) Suggest **one** reason why not all of the 350 million trees planted will grow into mature trees.

.....
 [1]

(ii) Suggest **one** reason why other countries do **not** have a similar reforestation programme.

.....
 [1]

(iii) Explain how reforestation can improve water security in a region.

.....

 [3]

(iv) In the past, eucalyptus trees were used to reforest areas of Ethiopia.

Eucalyptus trees are **not** native to Ethiopia.

Suggest the negative impacts of planting non-native trees.

.....

 [3]

- (v) Explain how reforestation can help manage climate change.

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..... [4]

[Total: 20]

- 5** A report stated that 3 billion people cook their food using stoves that require open fires.

Wood is a common fuel for the open fire used in these stoves. It takes a family around 20 hours per week to gather enough wood for the stove.

An unventilated open fire produces the same amount of air pollution in one hour as the smoke from 400 cigarettes. Smoke contains particulates.

Fig. 5.1 shows an unventilated wood burning stove.

Fig. 5.2 shows a stove powered by solar energy. Sunlight is reflected onto a metal pot from a panel with a shiny surface.

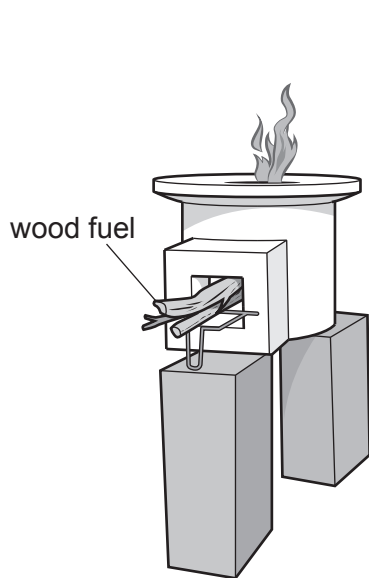


Fig. 5.1

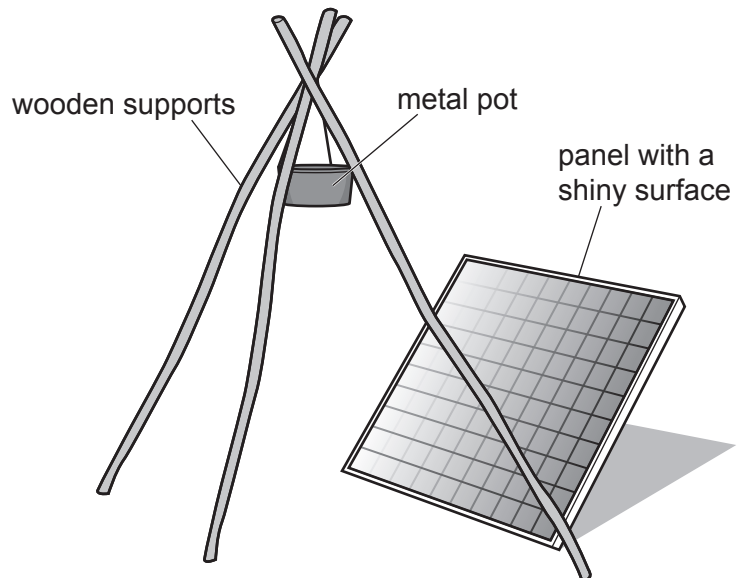


Fig. 5.2

- (a) Suggest the advantages and disadvantages of using a stove powered by solar energy compared with using an unventilated wood burning stove.

[illegible]

- (b) Fig. 5.3 shows the number of deaths (per 100 000 people) which are caused by indoor air pollution in different regions for one year.

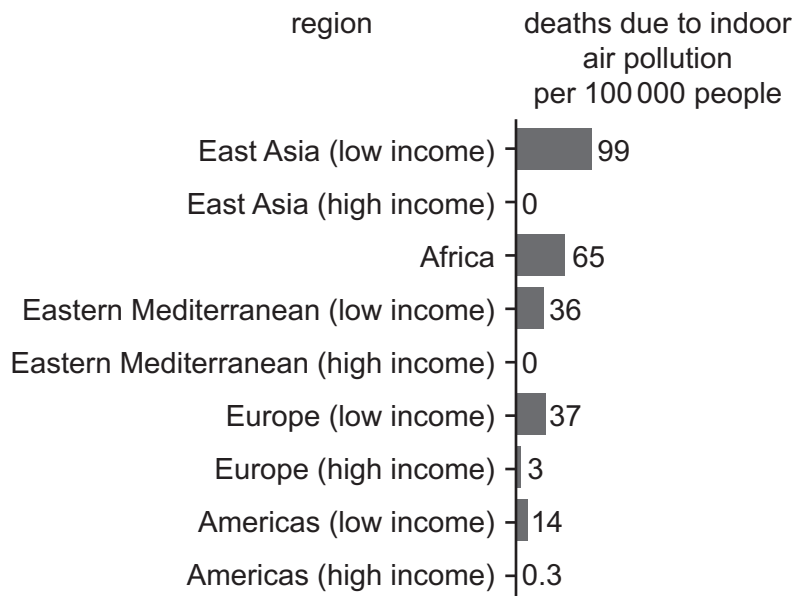


Fig. 5.3

For each region, the number of deaths due to indoor air pollution per 100 000 people was calculated using this formula.

$$\frac{\text{total number of deaths due to indoor air pollution in a region}}{100\,000}$$

- (i) Suggest the benefit of reporting the number of deaths due to indoor air pollution **per 100 000 people** in a region, rather than reporting the **total** number of deaths due to indoor air pollution in a region.

..... [1]

- (ii) Suggest reasons for the difference in the number of deaths due to indoor air pollution for people on a low income and people on a high income.

..... [3]

- (c) Fig. 5.4 is a blog about a strategy to manage pollution, called the polluter pays principle.

The polluter pays principle states that those who produce pollution should pay for the management of preventing damage to human health and to the environment.

In Switzerland, an extra cost is added to waste collection bags with pay-per-bag fees.

In the United States, polluters are required to pay for clean-up of hazardous waste sites. An extra cost is added to vehicles that have a low fuel efficiency.

Fig. 5.4

- (i) Suggest why the polluter pays principle described in Fig. 5.4 is **not** always implemented.

.....
 [1]

- (ii) Suggest why some people are against the polluter pays principle.

.....

 [2]

[Total: 13]

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