



**Cambridge Assessment  
International Education**

Example Responses – Paper 2

**Cambridge International AS Level  
Environmental Management 8291**

For examination from 2022



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## Introduction

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The main aim of this booklet is to exemplify standards for those teaching Cambridge AS Level Environmental Management 8291.

This booklet contains responses to all questions from June 2022 Paper 21, which have been written by a Cambridge examiner. Responses are accompanied by a brief commentary highlighting common errors and misconceptions where they are relevant.

The question papers and mark schemes are available to download from the [School Support Hub](#).

**8291 June 2022 Question Paper 21**

**8291 June 2022 Mark Scheme 21**

Past exam resources and other teaching and learning resources are available from the [School Support Hub](#).



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## Question 1

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- 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 trialed 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.

*Methane is a greenhouse gas. Greenhouse gases cause the enhanced greenhouse effect. Methane is non-renewable so will eventually run out.*

[3]

### Examiner comment

- Many responses stated 'it is renewable'. Candidates should avoid 'it' as it is not always clear what is being referred to.
- There was a widespread misconception that carbon dioxide causes ozone depletion.
- Less successful responses stated 'methane is harmful' or 'methane is polluting'. The terms 'harmful' and 'polluting' were insufficient to be awarded marks, candidates were expected to state how methane is harmful or polluting, e.g. it contributes to global warming.

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

1 *The trial was expensive so extending it to the whole of the UK will cost too much.*

2 *There might be readily available alternative fuels already in an area such as wind turbines.*

[2]

### Examiner comment

Responses that stated '83% of homes use methane' were repeating information in the stem of the question and could not be awarded marks for this repetition.

(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 *plant more trees to capture the carbon dioxide during photosynthesis*
- 2 *store the carbon dioxide as carbon underground*

[2]

### Examiner comment

- Some responses wrote in full sentences that repeated the question, e.g. ‘two strategies for removing carbon dioxide are...’. This was not required and wasted candidates’ time in the examination.
- A catalytic converter was stated by some candidates, but this was incorrect as these remove gases responsible for acid rain rather than carbon dioxide.
- Candidates needed to state a specific strategy; ‘use a machine’ was too vague.

- (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.

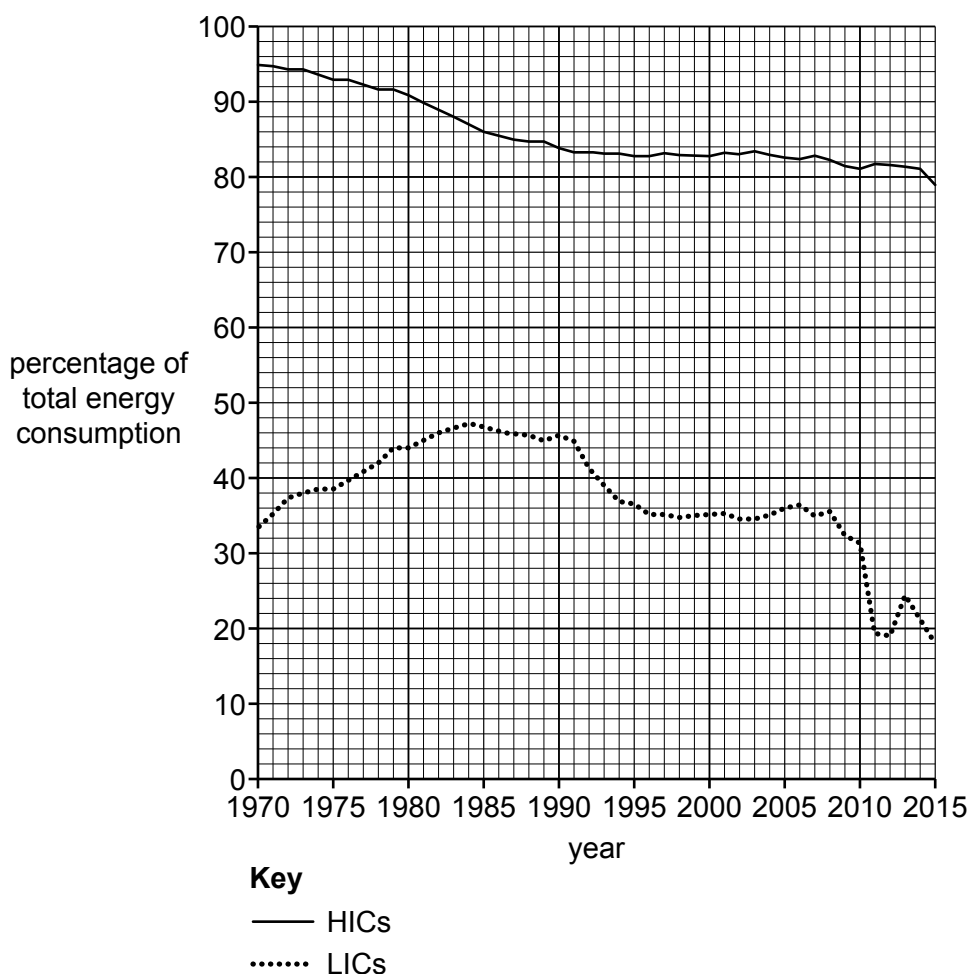


Fig. 1.1

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

*Both LICs and HICs have an overall decreasing trend.*

*HICs start with a fossil consumption than LICs.*

*HICs started at 95% and LICs started at 34%.*

*HICs decrease steadily but LICs fluctuate.*

[4]

### Examiner comment

- Some candidates gave four individual data quotes. This was insufficient as the question asked for a comparison of the trends.
- Some responses confused HICs and LICs.
- Comments about why there was a difference in the fossil fuel consumption did not answer the question.
- More successful responses were guided by the mark allocation as an indication of the number of points required. The use of bullet points helped these candidates give four separate comparative answers.

- (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.

*The exporting country can charge high prices that the importing country cannot afford. If the countries have a disagreement, like a war, the supply could be stopped.*

..... [2]

[Total: 13]

### Examiner comment

Some answers were too vague, such as ‘they might not have enough’. In this example, it is not clear who ‘they’ are and does not state what it is there might not be enough of and why this could lead to energy insecurity.

## Question 2

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

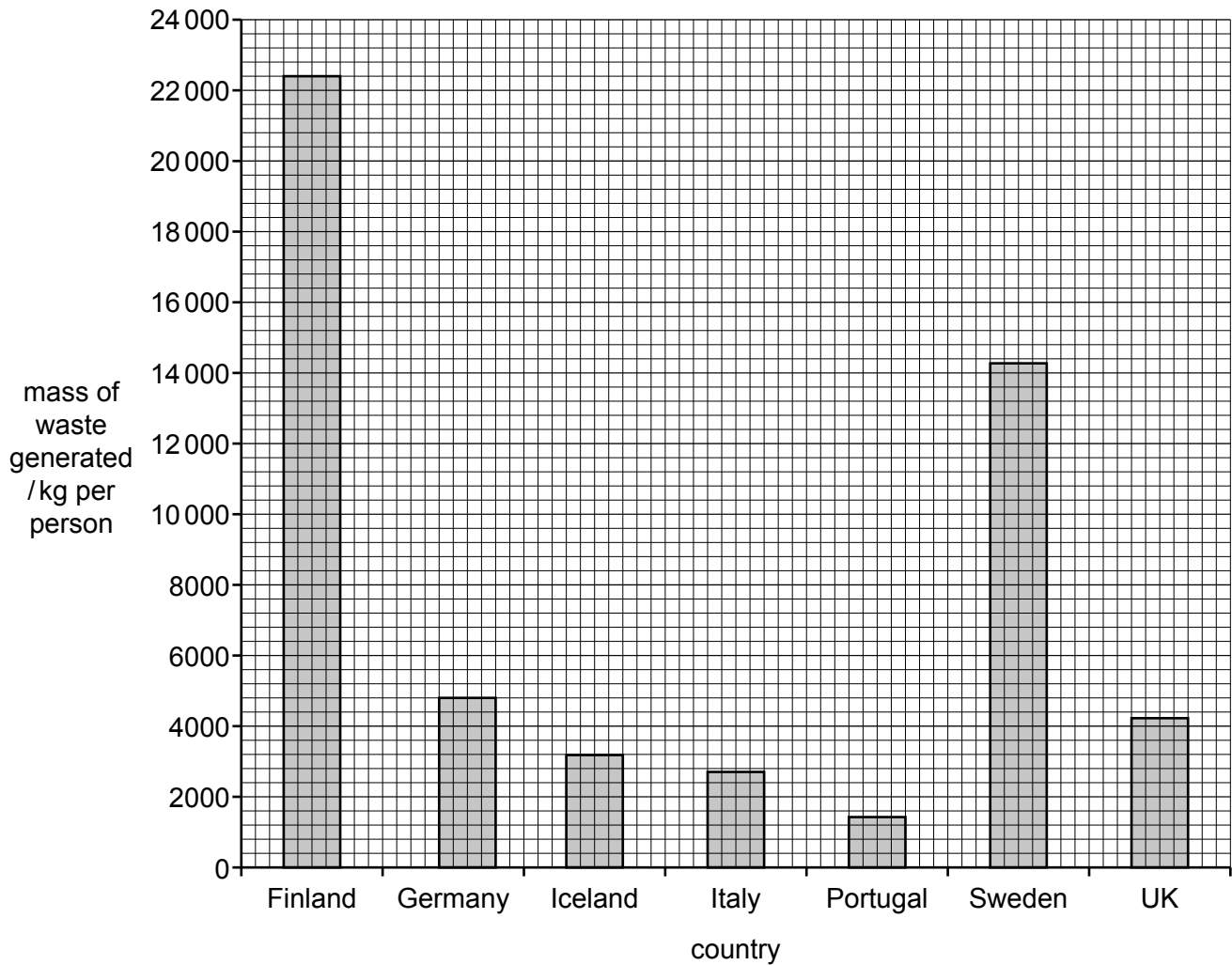


Fig. 2.1

(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.

*two* ..... [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

3120..... kg per person

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

13 440..... kg per person  
[2]

### Examiner comment

- Candidates found this percentage question challenging.
- Many misread the question for Finland and gave the mass of waste that was recycled.

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

1 Make it easy to understand what can and cannot be recycled......

2 Increase the number of places where things can be recycled......

[2]

### Examiner comment

Some candidates answered in terms of the importance of reduce, reuse and recycle. This is an important strategy, but does not directly answer this question.

(iv) Incineration is used to dispose of waste.

Suggest benefits and negative impacts of waste incineration.

benefits *The heat from incineration can be used to produce electricity.*

*Burning gets rid of a large amount of waste in a short time.*

negative impacts *Ash and smoke are produced which is a form of air pollution. This can cause lung problems such as asthma.*

[4]

### Examiner comment

- A common misconception was that incineration completely removes all waste. This is not the case as some materials cannot be burnt.
- It was insufficient to state ‘causes pollution’; candidates needed to clarify the type of pollution and give examples where possible.
- The question asked for both benefits and negative impacts. It was expected that both these aspects were discussed in candidates’ responses.

- (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.

*Benefits of the strategy are that Hong Kong and China are paid money for taking the waste.*

*Getting rid of the waste creates jobs for people in Hong Kong and China.*

*However, negative impacts are that Europe is passing the responsibility onto another country and the waste still needs to be disposed of.*

*Transporting the waste creates air pollution as fossil fuels are burnt and could also lead to pollution of the oceans if the waste leaks from ships.* [4]

### Examiner comment

The question asked for an evaluation. Evaluations should include positive and negative impacts.



(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.

*A really large amount of sewage and food waste could be created .....  
and this is too much to transport.* [1]

### Examiner comment

Candidates found this a challenging question. Many suggested that sewage is fed to penguins.

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

*The Antarctic Treaty says that waste should be removed.  
If it is left it could reduce biodiversity as animals could choke on  
plastic waste.* [2]

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

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

*Have a limit on the number of tourists allowed to visit and introduce permits for anyone who wants to visit.*

*The permits could be very expensive and this will put many people off visiting.*

*Have certain areas where tourists are not allowed to go to so that animals are not disturbed.*

[3]

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## Question 3

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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.

*the world population is increasing so more people are using  
artificial lights* ..... [1]

### Examiner comment

A common vague response was ‘there are more lights’; this could not be awarded marks as it was a simple repeat of the question.

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

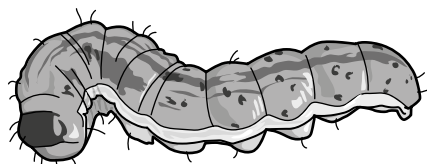
*Insects are pollinators and without pollinators crops cannot grow.  
This will lead to food shortages and famine as food chains collapse.*  
.....  
..... [2]

### Examiner comment

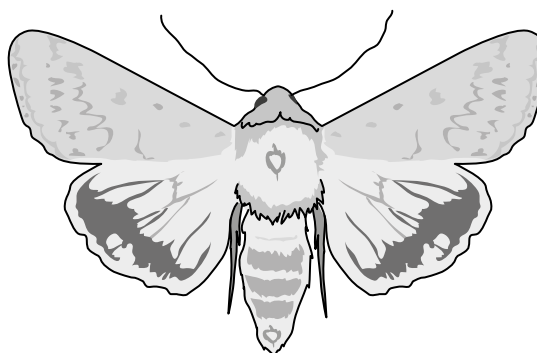
- Pollination was not widely known.
- ‘Habitat loss’ was often quoted. This was not sufficient to be awarded marks without a reason why the habitat was lost. For example, ‘habitats are lost because food chains collapse as insects are food for other animals.’

- (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	<u>250</u>

- (i) Complete Table 3.1 by calculating the mean (average) number of corn earworm moths collected in field **C**. [1]

### Examiner comment

A number of candidates did not respond to this question. Candidates should always make sure they have answered every part of the question paper including tables or diagram completion.

- (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** *every day*.....

field **B** *no spray*.....

[2]

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

1 *introduce a biological control*.....

2 *use genetically modified crops that are resistant to pests*.....

[2]

### Examiner comment

'Use of chemicals' was not awarded marks as the question ruled out the use of insecticides.

- (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.

*A random strategy can be used.*.....

*Number the fields 1 to 50.*.....

*Use a random number generator to select 3 numbers.*.....

[3]

### Examiner comment

- Candidates found this question challenging. Those that gave a clearly described strategy are likely to have had experience with field work.
- Descriptions of methods or sampling strategies should be clear enough that another student could follow the method given.

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

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

benefits *It is a low-cost method as a sweep net is not complicated equipment.*

*It's easy to use and collects many insects with each sweep.*

limitations *It takes a long time to collect the insects as it has to be done by a person and is not automated.*

*You can't pick which type of insect you collect.*

[4]

### Examiner comment

- The question asked for both benefits and limitations but some candidates only gave benefits.
- Occasionally, answers were contradictory. For example, 'it is quick to use' was given as a benefit and then 'it takes a long time' was given as a limitation.

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## Question 4

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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.

*using satellite images*.....

..... [1]

### Examiner comment

Many candidates gave implausible answers such as ‘walk around the country and count all the trees’.

(ii) Explain how deforestation reduces biodiversity.

*Habitat is lost and this means it is hard to hide from a predator.*.....

*There is less food which causes species to move away from an area.*.....

*The soil on the land that is left loses its fertility.*.....

*This leads to soil erosion so plants cannot grow there.*..... [2]

### Examiner comment

- Very few candidates explained four good points. Many answers were limited to loss of habitat.
- Less successful responses did not use syllabus specific terms and referred to ‘animals have no homes’.

- (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

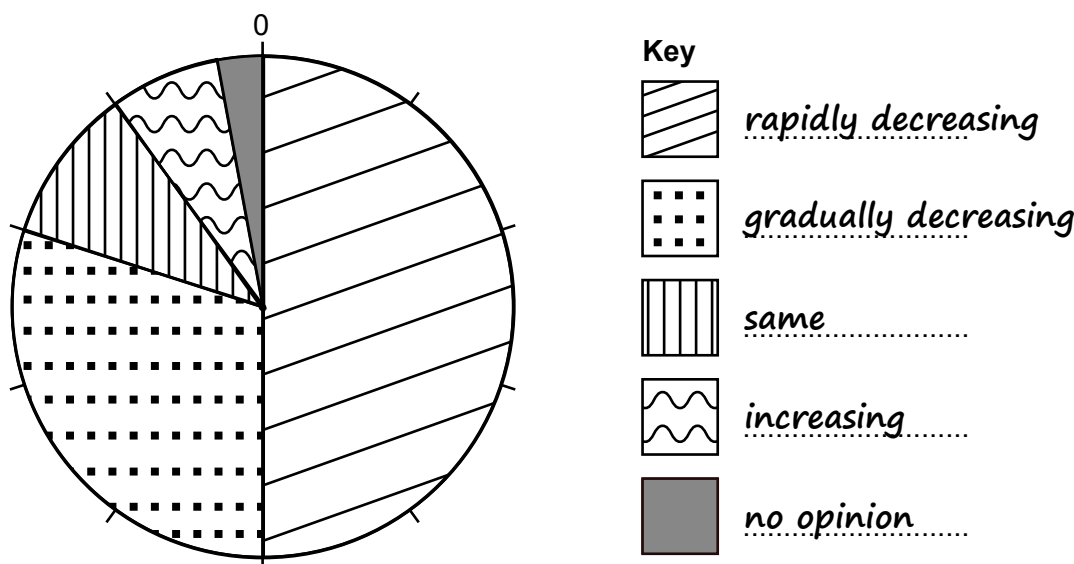
- (i) Write a suitable conclusion that summarises the main opinion on how forest cover has changed in Ethiopia.

*80% think the forest cover is decreasing compared to 10% who stated it was the same. A minority said was increasing or had no opinion on forest cover.* [1]

**Examiner comment**

A conclusion should summarise the key findings of an investigation, or in this case a questionnaire.

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



[3]

**Examiner comment**

- Candidates found drawing a pie chart very challenging. The majority did not use a ruler, so sectors were not accurate.
- Most used pen which meant if a mistake was made it was very difficult to correct the chart.
- The sectors were often not in rank order and the largest sector did begin at noon and proceed clockwise, as per the instructions in the syllabus.



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

*The size of the sample, which is the number of people surveyed.*.....

..... [1]

### Examiner comment

'Use a title' was a common irrelevant answer.

- (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.

*There was not enough water so the trees couldn't produce food by photosynthesis.*..... [1]

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

*Some countries have different things they need to spend their money on such as feeding the population.*..... [1]

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

*Trees improve the structure of soil as their roots bind the soil.*.....

*Tree cover reduces the evaporation from the soil.*.....

*Trees increase interception of water.*.....

*This means the soil can hold and absorb more water which allows groundwater stores to recharge.*.....

..... [3]

### Examiner comment

- Candidates found this a challenging question.
- Many discussed soil erosion, rather than water security.
- Some referred to evaporation but did not say where the evaporation occurred from and whether the evaporation increased or decreased (Decreased evaporation from soil and increased water evaporating from leaves).

- (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.

*Non-native trees can be invasive.*

*There are no natural predators for them and they can be toxic to native animals.*

*They out compete native trees so native trees die.*

[3]

### Examiner comment

A minority used the term 'invasive'.

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

*Trees capture carbon and store carbon.*

*Carbon dioxide is removed from the atmosphere by photosynthesis.*

*carbon dioxide + water → glucose + oxygen*

[4]

### Examiner comment

- Few candidates correctly stated an equation for photosynthesis.
- A large number of candidates thought trees reduce the impact of ozone depletion and that this linked to climate change.

## Question 5

- 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.

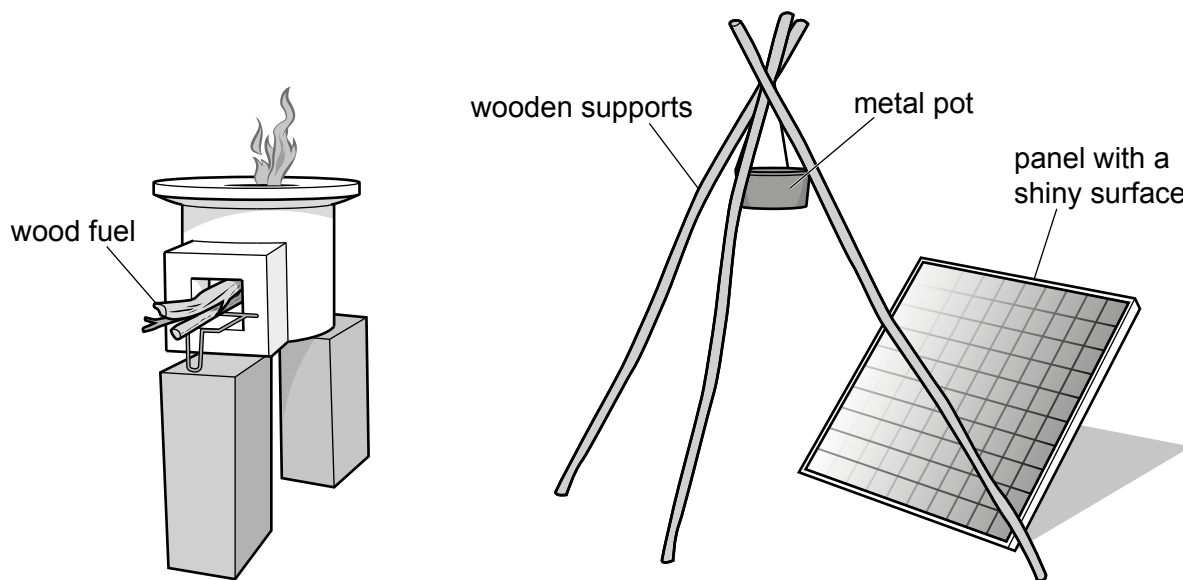


Fig. 5.1

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.

*advantages:*

*Solar energy is renewable, wood stove is not.*

*You don't need to collect wood for hours as solar energy uses the*

*Sun so solar energy takes less time.*

*Trees are not cut down for fuel with solar.*

*disadvantages:*

*The shiny panel is expensive but wood stove just uses wood.*

*You can't use solar when it is nighttime, wood can be used any time.*

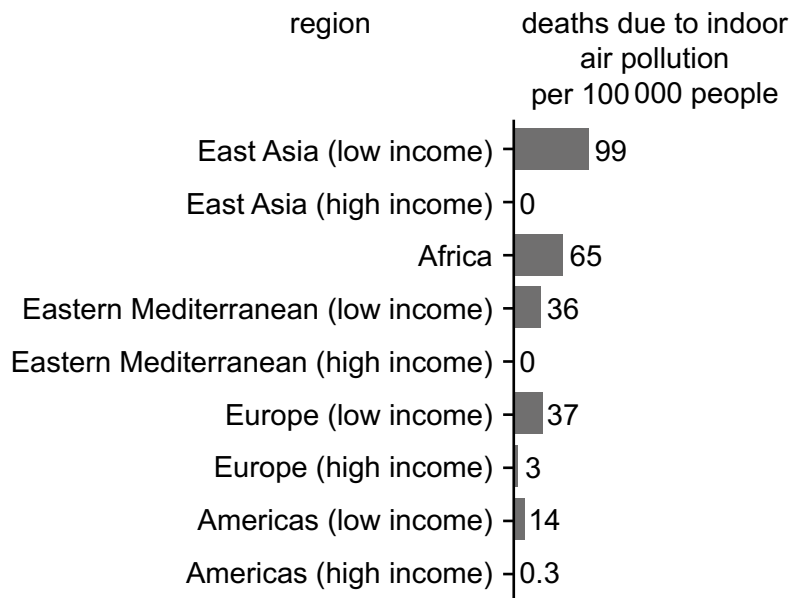
*Solar has to be used outside, wood stove can be used inside.*

[6]

**Examiner comment**

This question asked for advantages and disadvantages. Some responses did not make it clear whether they considered a point to be an advantage or disadvantage and which stove they were referring to.

- (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.

*so that countries with different numbers of people can be compared*

..... [1]

**Examiner comment**

Few candidates gave a correct answer to this question. Many stated that it was ‘easier for people to understand.’

- (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.

*People on a low income have more wood stoves indoors.*  
*They cannot afford proper ventilation to remove the smoke for these stoves.*  
*They cannot afford medical treatment when they get a lung problem.* [3]

### Examiner comment

'Not having enough money' was a common answer. This was a repeat of the question so could not be awarded marks.

- (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.

*It's hard to prove how causes pollution as everyone pollutes in some way.* [1]

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

*People are worried they might lose their jobs if they work in an industry that pollutes. Some less polluting technologies are too expensive for people such as electric vehicles so they have no other options but to burn fossil fuels.* [2]

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