



Rewarding Learning

ADVANCED
General Certificate of Education
2023

Centre Number

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Candidate Number

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Environmental Technology

Unit A2 1
Building and Managing a
Sustainable Future

MV18

[AET11]

FRIDAY 2 JUNE, MORNING

Time

2 hours, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Complete in black ink only.

Answer **all** questions.

Information for Candidates

The total mark for this paper is **100**.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Questions **5(b)**, **7(a)** and **9**.

1 (a) (i) Name the process which uses bacteria to extract metals from low grade ore which is an alternative to traditional metal smelting. [1 mark]

(ii) Give **two** reasons why traditional metal smelting technology is detrimental to the environment. [1 mark for each]

1. _____

2. _____

(b) Another extraction technique uses plants to extract metal from metal ore mine tailings. **Table 1** shows the names of metals which can be extracted by plants.

(i) Give the names of the plants which can extract the metals shown in **Table 1**. [2 marks]

Table 1

Name of Plant	Metal extracted
	Copper
	Gold

(ii) Describe, using **four** stages, the process of how metal ore is extracted by plants. [4 marks]

2 In order to reduce the carbon dioxide emissions caused by the transportation sector the government and local councils have tried many different initiatives.

(a) One method of reducing carbon emissions is to use alternative fuels. Biomass can be used to create a fuel called bioethanol.

(i) Complete the chemical equation for the conversion of biomass into bioethanol. [3 marks]



(ii) Describe the industrial production of bioethanol from sugar cane and give the name of the process. [3 marks]

(b) Outline **two** different strategies designed to reduce transport demand and explain how each strategy reduces CO₂ emissions in the transport sector.
[1 mark for each strategy, 2 marks for each explanation]

Strategy _____

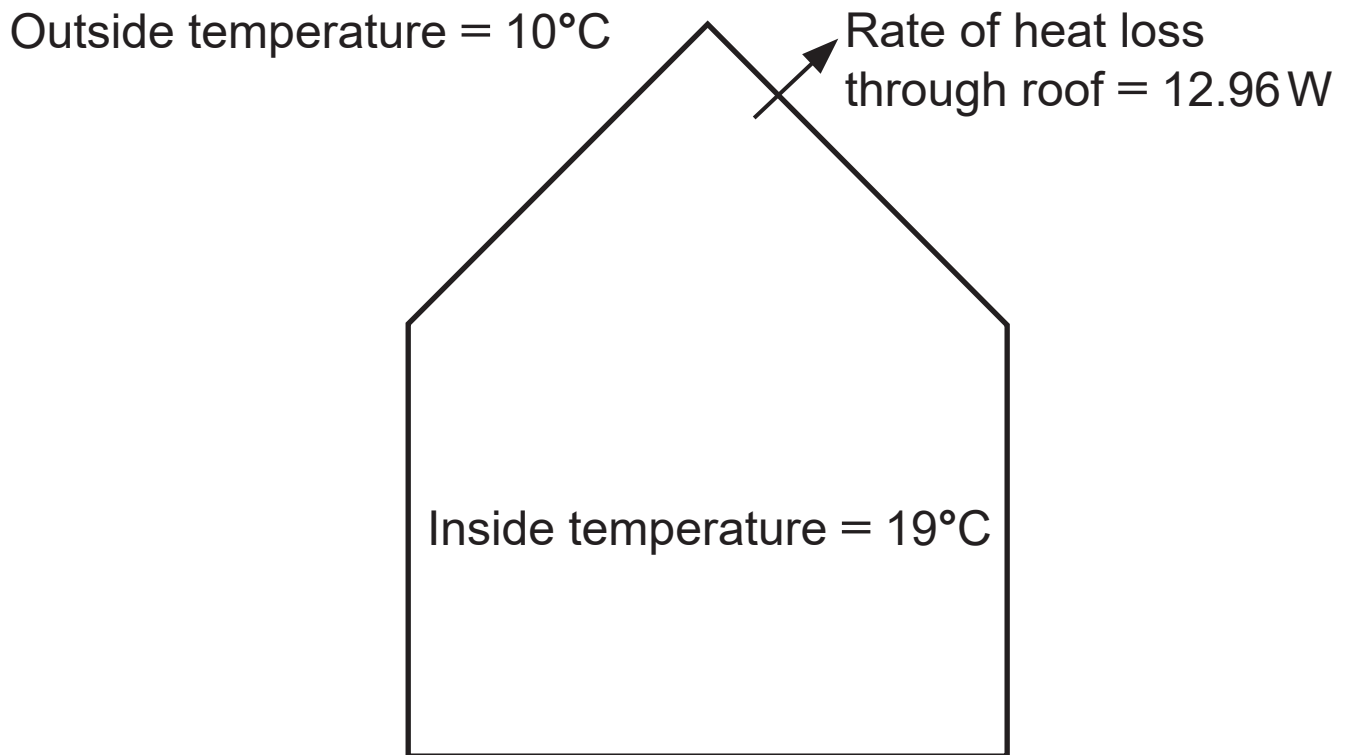
Explanation _____

Strategy _____

Explanation _____

3 (a) (i) Define the term U value. [2 marks]

Fig. 1 Basic section of a house



- (ii) Calculate the U value for the roof of the house shown in **Fig. 1** if the section of roof being considered measures 2.4 m by 6 m. [4 marks]

Show your working out in the space below.

Answer _____ W/m²K

- (b) (i) Explain **two** challenges of the UK government's policy to improve the environmental performance of existing housing through the use of the Code for Sustainable Homes. [2 marks for each]

1. _____

2. _____

- (ii) Name an alternative environmental building performance measurement system which can be used to assess buildings. [1 mark]
- _____

4 One method for producing hydrogen gas in bulk is the steam reforming of fossil gases.

(a) Describe this process. [4 marks]

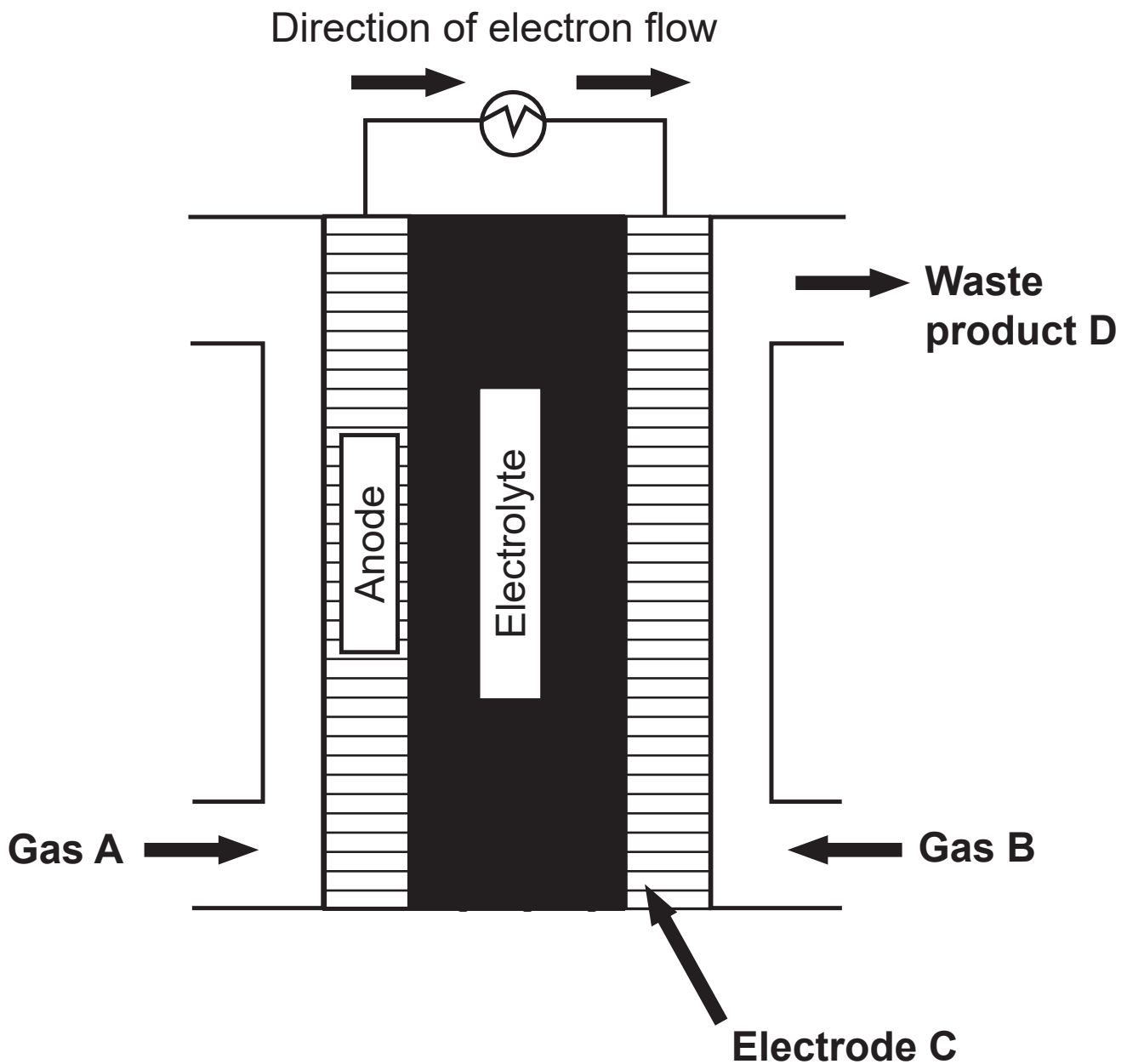
(b) Name **two** other methods used for the bulk production of hydrogen. [1 mark for each]

1. _____

2. _____

(c) Fig. 2 shows a diagram of a PEM fuel cell.

Fig. 2



Name each of the following in **Fig. 2**:

[1 mark for each]

Gas **A**: _____

Gas **B**: _____

Electrode **C**: _____

Waste product **D**: _____

(d) Describe **two** different applications of hydrogen fuel cells. [2 marks for each]

1. _____

2. _____

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5 Reducing reliance on landfill is one of the main objectives of the Northern Ireland Waste Management Strategy.

(a) Name **two** priority waste streams identified in the Northern Ireland Waste Management Strategy.

[1 mark for each]

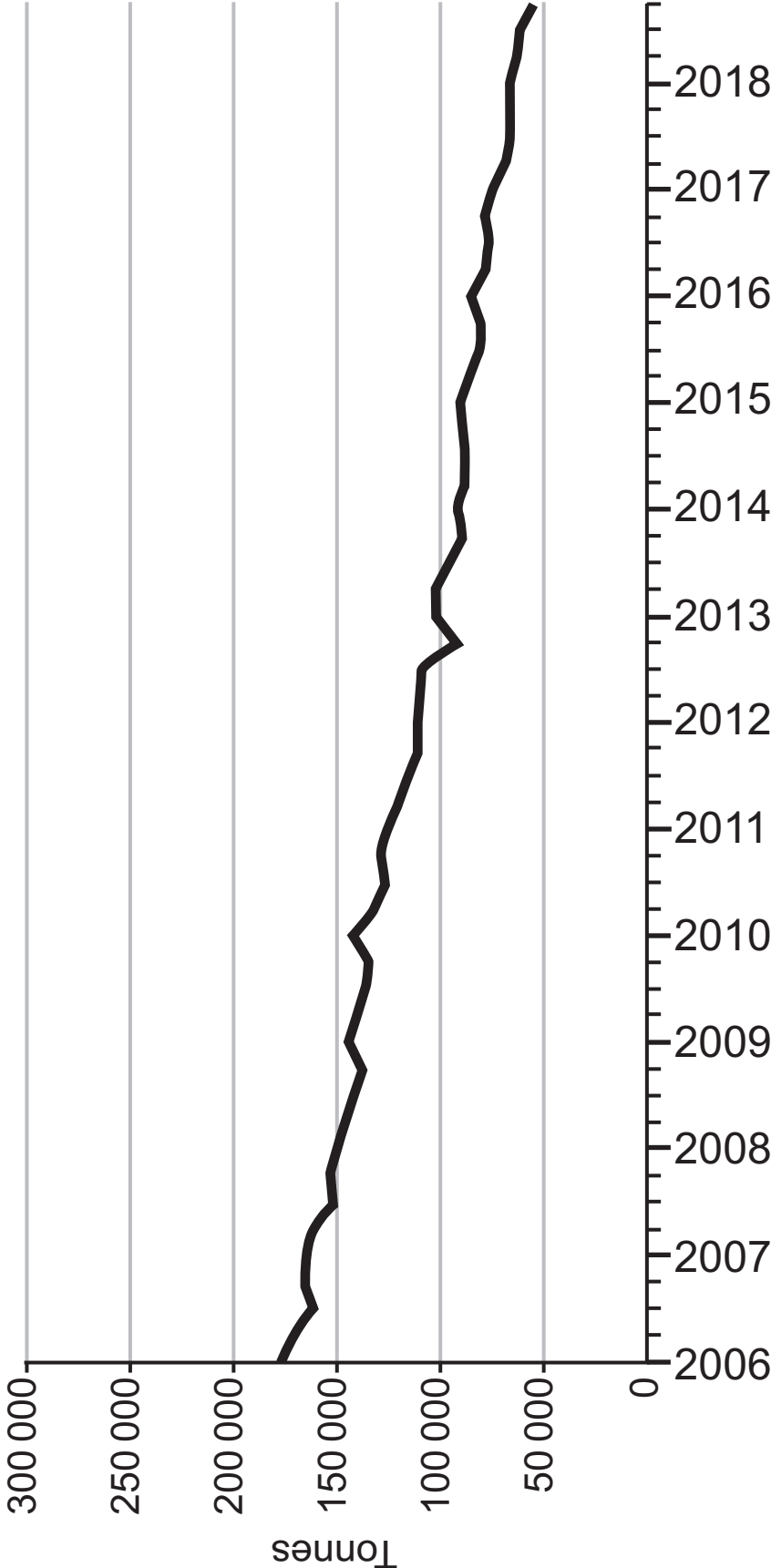
1. _____

2. _____

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(Questions continue overleaf)

The graph, **Fig. 3**, shows the amount of household waste which has been sent to landfill between 2006 and the end of 2018.

Fig. 3



6 Fig. 4 shows an image of an anaerobic digestion plant.

Fig. 4



(a) State what is meant by the following key terms associated with anaerobic digestion.

[1 mark for each]

Low solids: _____

Residence time: _____

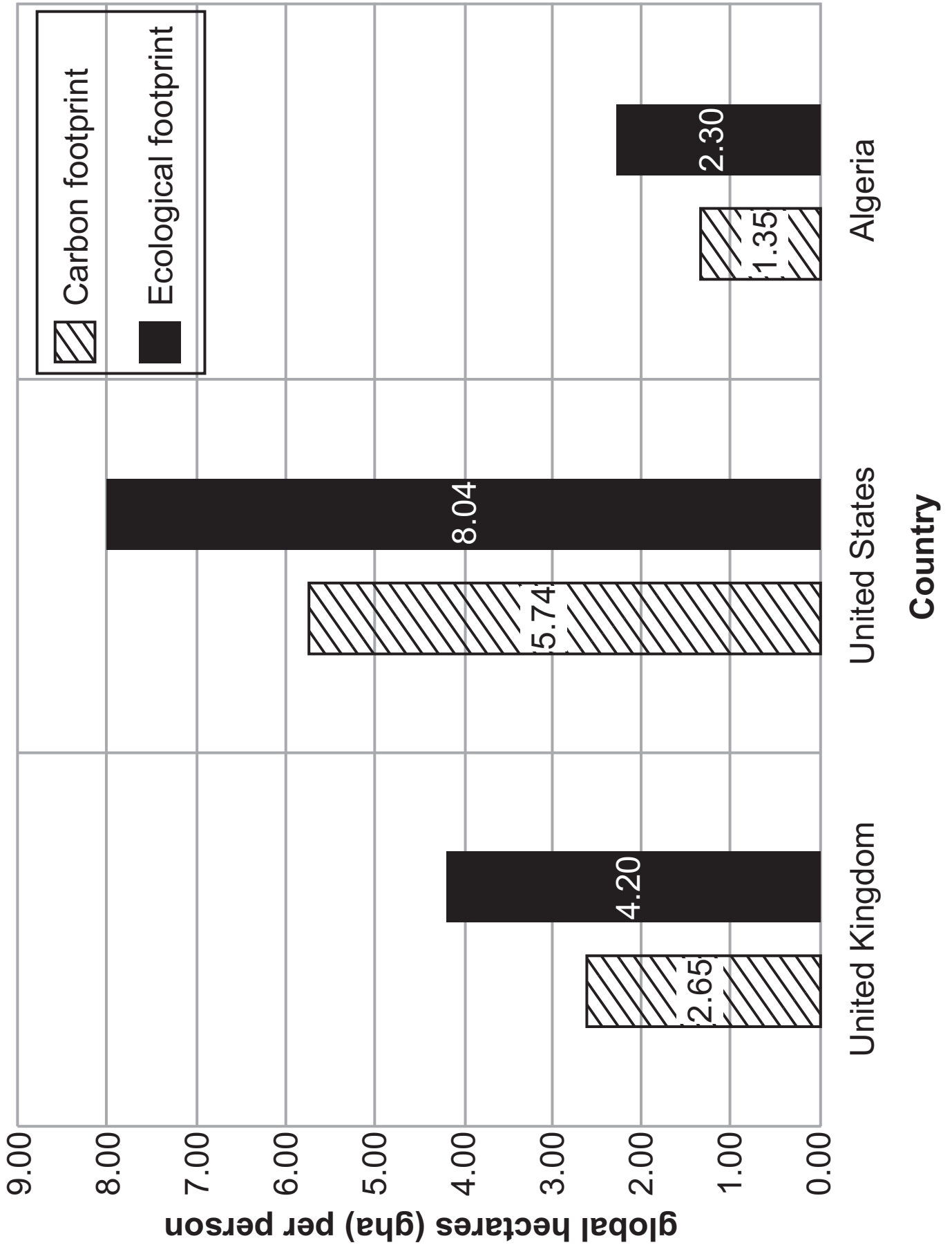
Single stage: _____

(b) Explain how anaerobic digestion can deliver both heat and power. [4 marks]

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(b) The graph in **Fig. 5** shows the ecological and carbon footprint for people in three different countries.

Fig. 5



Discuss the concept and measurement of an ecological footprint and the link between an ecological footprint and a carbon footprint making reference to **Fig. 5** where appropriate. [2 marks for each]

Concept of an ecological footprint:

Measurement of an ecological footprint:

Link between an ecological footprint and a carbon footprint:

8 Linking isolated rural dwellings to waste water treatment, energy supply and communication networks causes problems in terms of cost and environmental impact.

(a) Discuss these problems. Include **one** discussion point for each problem. [2 marks for each]

Cost:

Environmental Impact:

(b) Describe **one** solution for each of the three named issues (i), (ii) and (iii) that would improve sustainability for rural communities. [2 marks for each]

(i) Energy supply:

(ii) Communication networks:

(iii) Waste water treatment:

This is the end of the question paper

SOURCES

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Fig.4 © Getty Images

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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