Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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8	
TOTAL	

General Certificate of Education
Advanced Level Examination
June 2015

Environmental Studies ENVS3

Unit 3 Energy Resources and Environmental Pollution

Thursday 11 June 2015 9.00 am to 10.30 am

You will need no other materials.
You may use a calculator.

Time allowed
- 1 hour 30 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
  Two of these marks are for the Quality of Written Communication.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.
- Question 8 should be answered in continuous prose.
  Quality of Written Communication will be assessed in this answer.

A

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ANSWER IN THE SPACES PROVIDED

Answer **all** questions in the spaces provided.

1 **Table 1** shows some abbreviations and technical terms that are linked to pollution issues.

Add **one** tick to **each** row to show the pollution issue to which the term is **mainly** linked.

The first row has been completed for you.

[5 marks]

Table 1

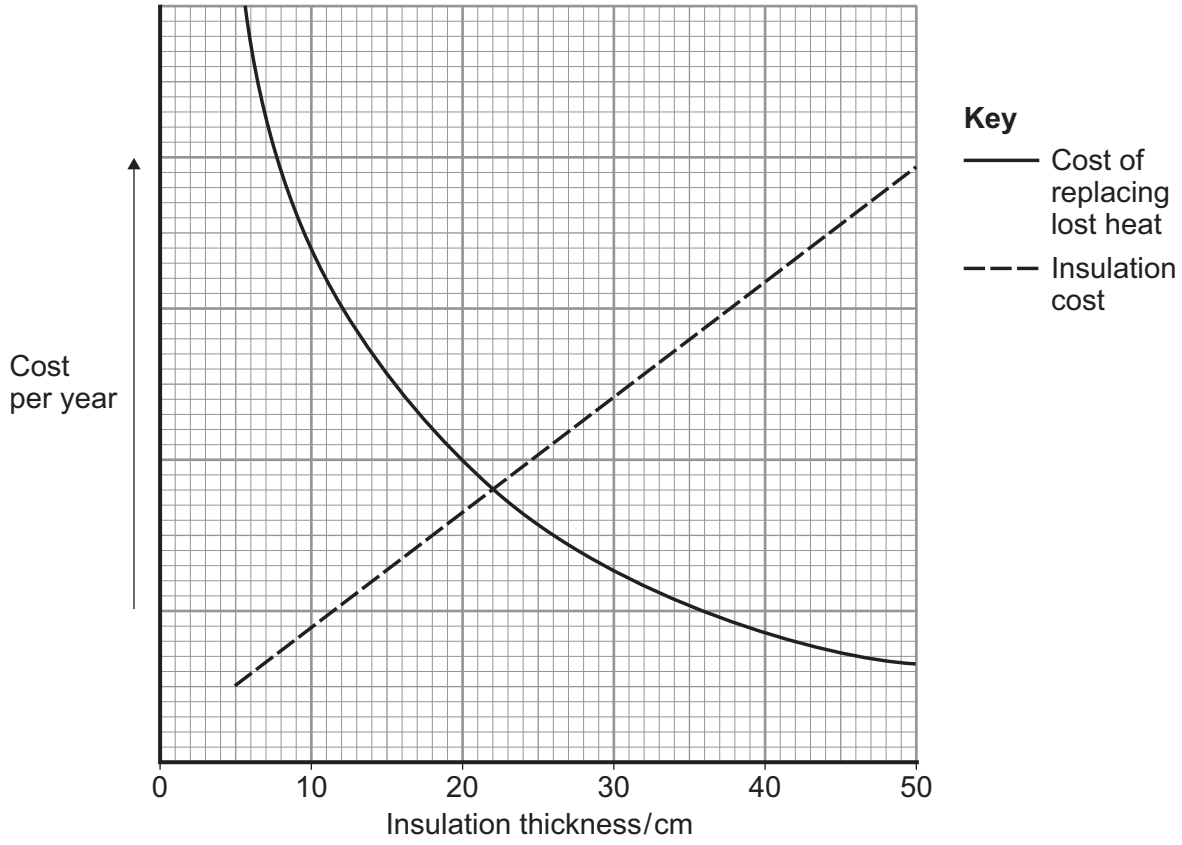
Abbreviation / technical term	Pollution issue					
	Noise	**Sulfur dioxide**	**Photo-chemical smog**	**Smoke**	**Ionising radiation**	**Oil**
Dry FGD		✓				
Critical Pathway Analysis (CPA)						
PANs						
NNI						
SPM						
Bacterial Bioremediation						

5

Turn over for the next question

2 **Figure 1** shows details of an insulation scheme for a house roof.

Figure 1



2 (a) What thickness of insulation is the economic optimum, producing the lowest total expenditure?

[1 mark]

.....cm

2 (b) Suggest **two** reasons why some people may choose to install insulation which is thicker than the economic optimum.

[2 marks]

1 .....

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2 .....

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2 (c) Explain how the design of a house can be changed to increase passive solar heating.
[2 marks]

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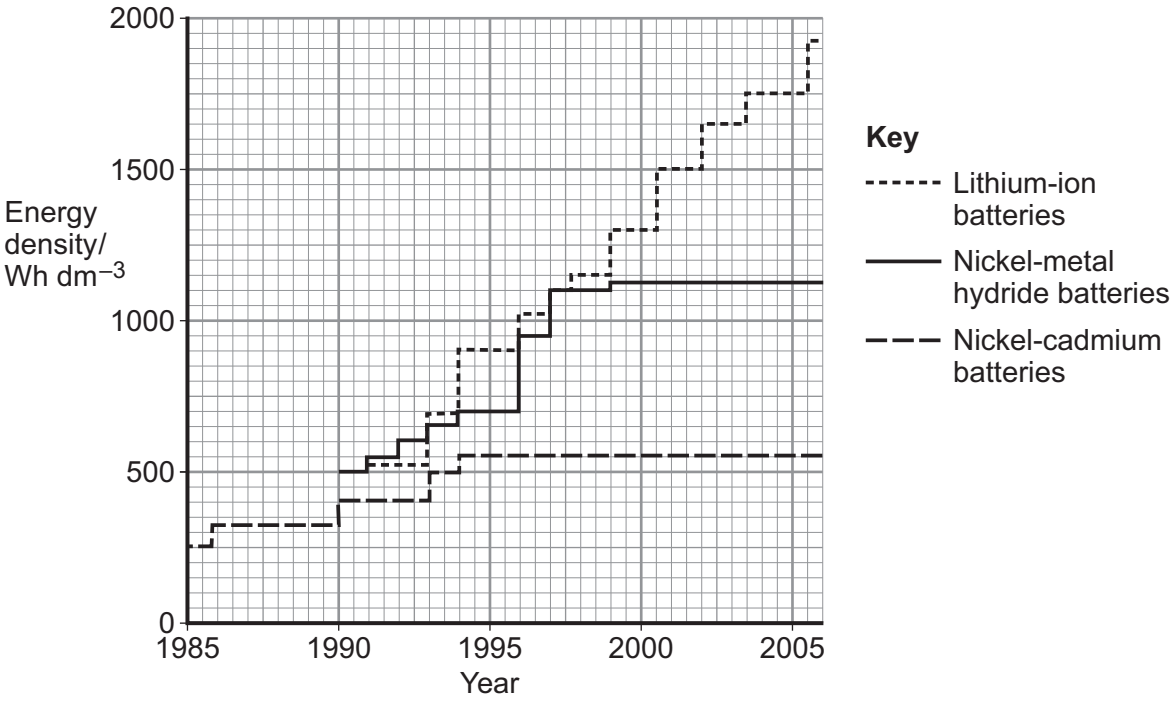
Turn over for the next question

3 **Figure 2** shows how the energy density of three battery types changed between 1985 and 2006.

Figure 2



3 (a) Compare the trend in energy density for lithium-ion batteries with that for nickel-metal hydride batteries.

[2 marks]

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3 (b) Suggest **one** reason for the trend in energy density for nickel-cadmium batteries.

[1 mark]

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3 (c) Explain how the change in energy density affects the usefulness of batteries to power cars.

[1 mark]

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3 (d) What form of energy is stored in batteries?

[1 mark]

Tick (✓) **one** box.

chemical energy ☐

electrical energy ☐

gravitational potential energy ☐

nuclear energy ☐

3 (e) A new design of battery is the 'bio-battery'. This design is based on glucose rather than on metals such as lead, nickel or cadmium.

Suggest **three** advantages of using bio-batteries rather than batteries based on metals.

[3 marks]

1 .....

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2 .....

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Question 3 continues on the next page

3 (f) Give **one** method used in industry to protect workers from lead.

[1 mark]

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3 (g) Batteries that use mercury are banned in most countries.

Why are greater safety precautions needed when using **organic** mercury compounds than when using **inorganic** mercury compounds?

[1 mark]

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10

Turn over for the next question

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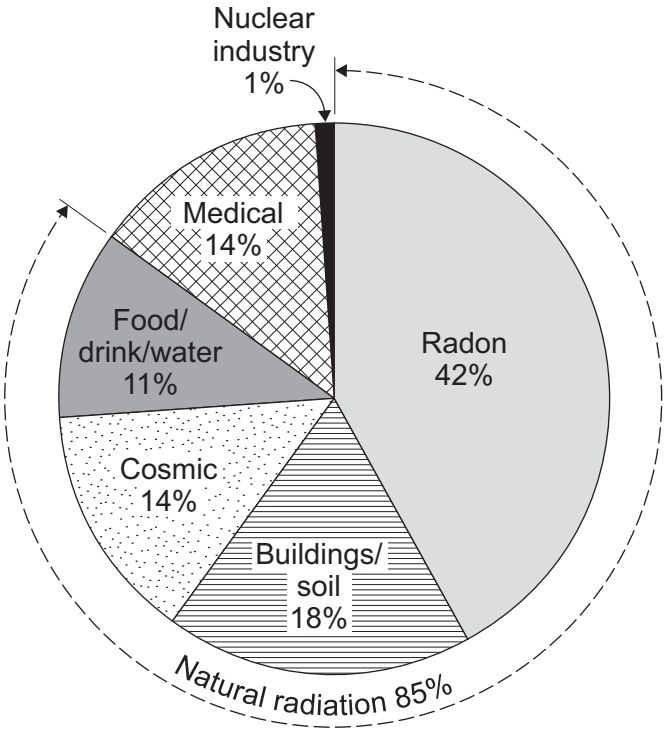
ANSWER IN THE SPACES PROVIDED

4 **Figure 3** shows the sources of public exposure to ionising radiation.

Figure 3



4 (a) Suggest **three** factors that may cause an individual's exposure to ionising radiation to be different from the average public exposure.

[3 marks]

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4 (b) Explain the difference between the terms **exposure** and **contamination** as applied to ionising radiation.

[2 marks]

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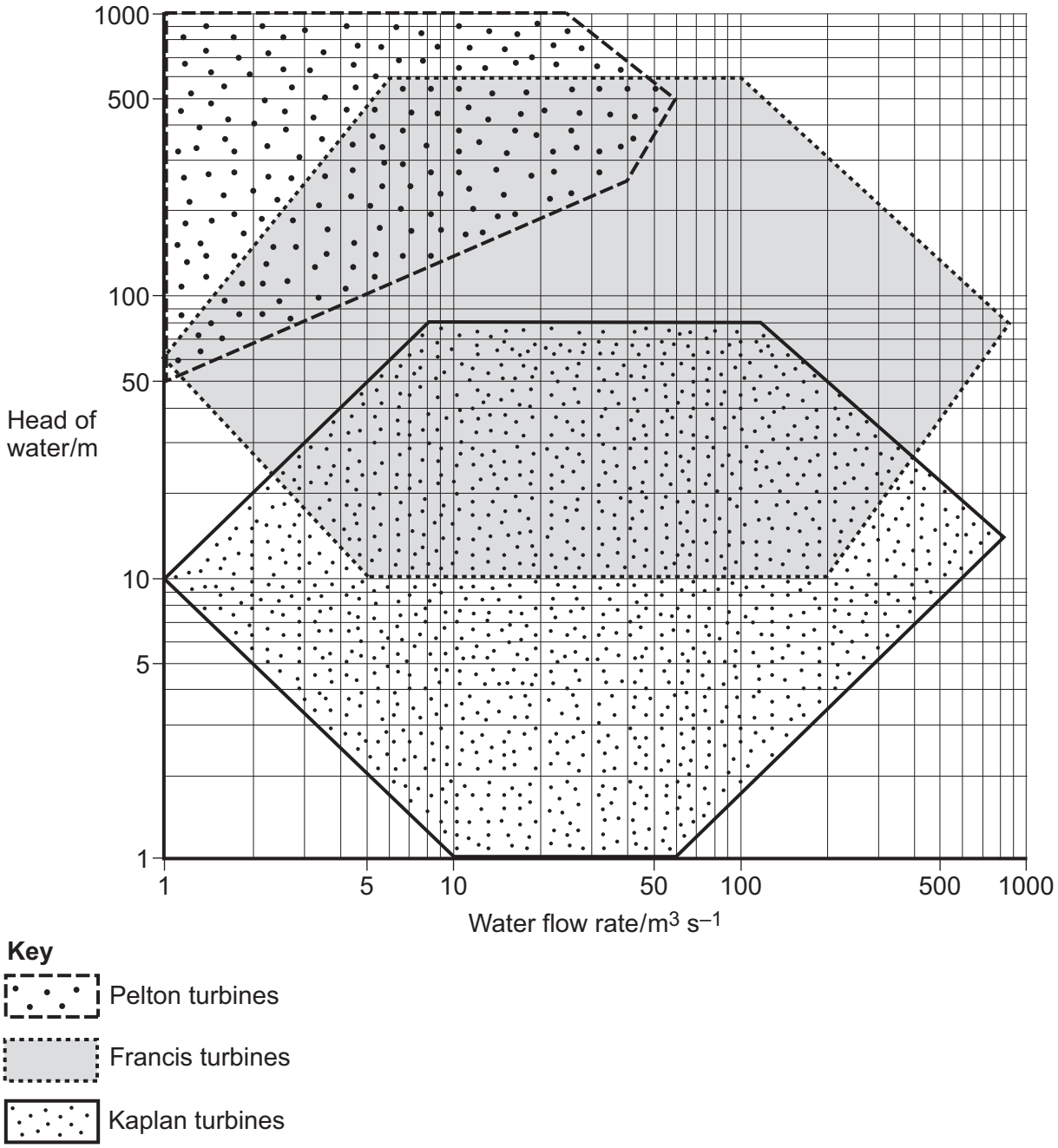
Turn over for the next question

5 **Figure 4** shows the ranges of conditions under which three different types of hydroelectric turbine can operate.

Figure 4



5 (a) What is the lowest flow rate at which Kaplan turbines can operate?

[1 mark]

..... $m^3 s^{-1}$

5 (b) Which turbine type operates over the smallest range of head of water?

[1 mark]

.....

5 (c) What are the lowest and highest flow rates at which both Kaplan and Francis turbines can be used if the head of water is 50 m?

[1 mark]

lowest = ... $m^3 s^{-1}$

highest = ... $m^3 s^{-1}$

5 (d) The generating capacity of hydroelectric power (HEP) in the UK is 3% of the total electricity supply.

Explain why it is difficult to find suitable sites in the UK for a big expansion of HEP output.

[3 marks]

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Question 5 continues on the next page

5 (e) All energy resources result in the release of some carbon emissions.

Discuss the extent to which HEP may be considered a carbon-free energy resource.

[4 marks]

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6 Agrochemicals such as pesticides and fertilisers increase food production, but they may also cause environmental damage.

6 (a) Explain how the properties of different pesticide groups affect the environmental damage they cause.

[5 marks]

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6 (b) Outline an experiment to investigate the effect of inorganic nutrients on the growth of aquatic plants or algae.

[5 marks]

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Turn over for the next question

7 The continued increase in air travel is a very controversial issue. Heathrow Airport, west of London, is an important source of noise nuisance. Great efforts have been made to control noise emissions.

Aircraft operations are given values called Quota Counts (QCs), based on their noise levels.

Table 2 shows the Quota Counts (QCs) for particular noise ranges.

Table 2

Noise Level / dB	Quota Count (QC)	Night flights permitted?
> 101.9	16	No
99 – 101.9	8	No
96 – 98.9	4	Yes
93 – 95.9	2	Yes
90 – 92.9	1	Yes
87 – 89.9	0.5	Yes
84 – 86.9	0.25	Yes
< 84	exempt	Yes

7 (a) Suggest why the QC doubles for each 3 dB increase in noise level.

[1 mark]

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7 (b) The noise emissions for each type of aircraft are given two QCs, one for landings and one for take-offs.

Table 3 shows the landing and take-off QCs for a range of aircraft types.

Table 3

Aircraft type	QC landing	QC take-off
Airbus A320 family	0.25 – 0.5	0.5 – 1
Airbus A380	0.5	2
Boeing 737 Classic	1	0.25 – 0.5
Boeing 747-400	2	4
Boeing 747-8	1	2
Boeing 757-200	0.25	0.5
Boeing 767-300	1	1 – 2
Boeing 777-200ER	1	2
Embraer 145	0.25	0.25

The number of night landings and take-offs at Heathrow Airport is limited to a total of 5800 per year.
The total permitted QC for all night flights at Heathrow Airport is 9180 per year.

7 (b) (i) Calculate the maximum number of night take-offs per year that would be permitted for the following aircraft.

[2 marks]

Boeing 747-400 .....

Boeing 757-200 .....

7 (b) (ii) Suggest how the QC system encourages airlines to buy quieter aircraft.

[1 mark]

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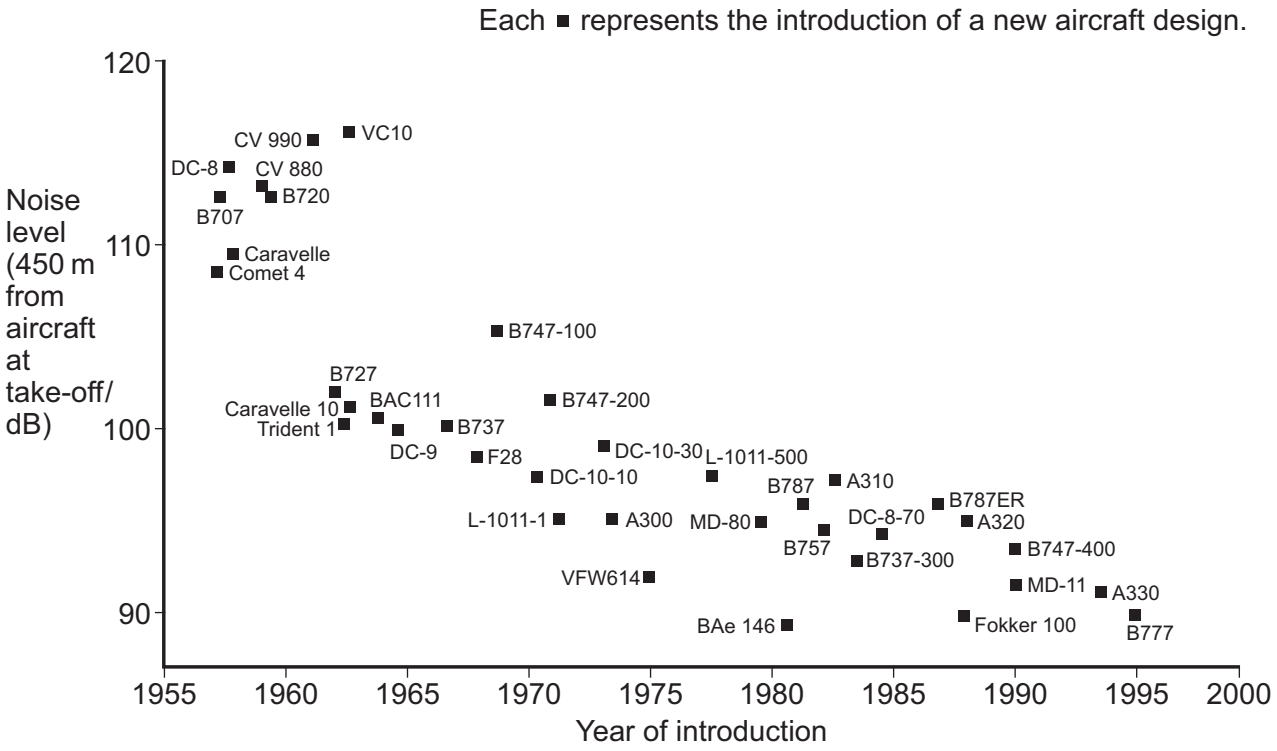
Question 7 continues on the next page

7 (c) **Figure 5** shows how aircraft noise emissions have changed as new aircraft designs have been introduced.

Figure 5



Outline how **one** change in aircraft design has contributed to the trend shown in **Figure 5**.

[2 marks]

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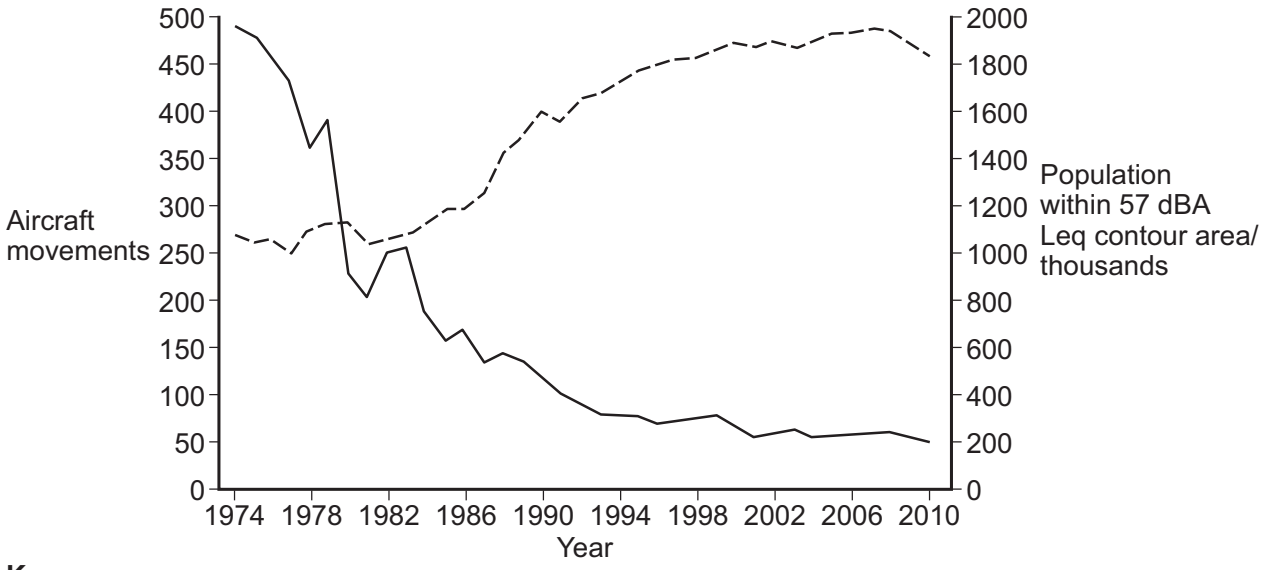
7 (d) **Figure 6** shows changes in air travel and noise exposure around Heathrow Airport.

Figure 6



Key

– – – – – Aircraft movements (thousands) per annum

——— Population (thousands) within the 57 dBA area

7 (d) (i) Describe the trends shown in **Figure 6**.

[1 mark]

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7 (d) (ii) Apart from changes in aircraft design, outline the changes that may have resulted in the change in noise exposure shown in **Figure 6**.

[2 marks]

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Turn over ▸

7 (e) Outline an experiment to investigate the effect of increasing distance from an airport on the volume of aircraft noise detected.

[6 marks]

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8 Write an essay on **one** of the following topics.

Credit will be given for your understanding of the relationship between different areas of the subject, also for the organisation and presentation of the essay and for grammar, punctuation and spelling.
You should answer this question in continuous prose.

Either

8 (a) Discuss the problems that would be caused by a greater dependence on renewable energy resources **and** outline the methods that may be used to reduce these problems.

[20 marks]

or

8 (b) Explain how the choices about energy use made within a country may affect development **and** quality of life in other countries.

[20 marks]

or

8 (c) Compare the advantages **and** disadvantages of the methods that are used to deal with solid wastes.

[20 marks]

Which question have you chosen?

Tick (✓) **one** box.

8 (a) ☐

8 (b) ☐

8 (c) ☐

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Extra space for Question 8 .....

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END OF QUESTIONS

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Figure 5 Cambridge University Press/Dr Sjoerd Rienstra, adapted from Michael J.T. Smith, Aircraft Noise 2009
Figure 6 Heathrow Airport Ltd