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Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Level Examination
June 2011

Environmental Studies

ENVS3

Unit 3 Energy Resources and Environmental Pollution

Wednesday 8 June 2011 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.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



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

- 1** Complete **Table 1** by adding the names of suitable energy resources.

Table 1

Energy resource	Description
	Energy density very high
	Releases CO ₂ on combustion but overall use can be carbon neutral
Fossil fuels	Non-renewable resources of biological origins
	Intermittent and unreliable
	Intermittent and reliable
Geothermal power	Renewable but not solar-derived
	Renewable energy resource that can be stored as gravitational potential energy

(5 marks)

5



- 2** Complete **Table 2** by adding a specific pollution application of **each** of the following units or abbreviations.

Table 2

Unit or abbreviation	Pollution application
dB	
pH	
NNI	
BOD	The measurement of deoxygenation of water caused by bacterial decomposition of organic matter
SPM	
TSS	The measurement of the turbidity of water
PANs	

(5 marks)

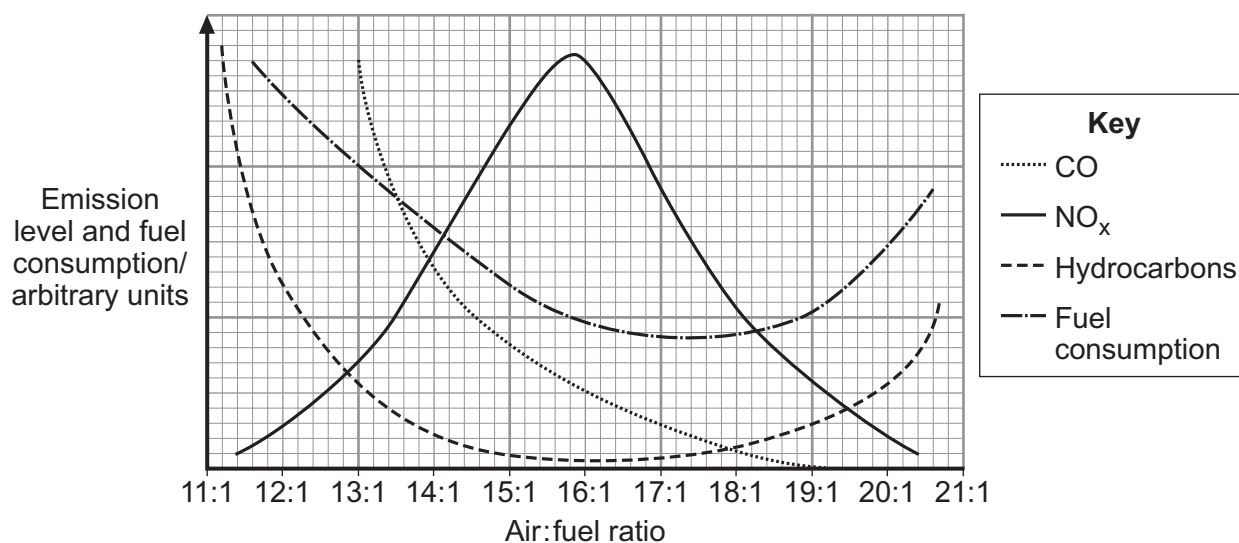
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Turn over for the next question

Turn over ►



- 3** The graph shows the pollutant concentrations and fuel consumption in petrol engine emissions for different air: fuel ratios before the gas emissions enter a catalytic converter.



- 3 (a)** The concentration trends are different for each line on the graph. Use the graph to suggest why the overall ideal air: fuel ratio is about 18:1.

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(3 marks)

- 3 (b)** Describe how oxides of nitrogen may cause the production of a secondary pollutant.

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(2 marks)



3 (c)

Describe how suitable sample sites may be selected to monitor the effect of atmospheric pollution on lichen distribution in an urban area.

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(5 marks)

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- 4 The photograph shows a ship tanker used to transport crude oil.



- 4 (a) Outline **two** features of ship tanker design that are intended to reduce the risk of oil pollution.

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(4 marks)



- 4 (b)** Outline ways in which living organisms may be affected by oil pollution even though they were not directly harmed by the oil.

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(4 marks)

- 4 (c)** Explain how the bioremediation of oil spills is affected by the temperature.

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(2 marks)

Turn over for the next question

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Turn over ►



- 5 **Table 3** shows the energy densities of a range of energy resources.

Table 3

Energy resource	Energy density/MJ kg ⁻¹
Hydrogen	130
Oil	42
Coal	28
Wood	15

- 5 (a) Outline **two** ways in which energy density may affect the usefulness of an energy resource.

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(2 marks)

- 5 (b) Explain how the use of hydrogen as a secondary fuel may help to increase the usefulness of renewable energy resources such as wind and solar power.

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(3 marks)



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- 6** **Table 4** shows the embodied energy and density of a range of materials.

Embodied energy is the total energy required to extract, process, transport and manufacture the materials.

Table 4

Material	Density/kg m ⁻³	Embodied energy /MJ kg ⁻¹	Main energy-using manufacturing process
Aluminium	2700	230–340	Electrolysis of bauxite
Copper	8920	60–120	Chemical reduction of ore
Plastics	900–1380	60–120	Fractional distillation of oil
Paper	500–850	25–50	Pulping and drying of wood fibres
Steel	7750–8050	20–25	Chemical reduction of iron ore
Bricks	1700–1925	2–5	Baking clay

- 6 (a)** Suggest **two** reasons why a range of values is given for the embodied energy of the materials.

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(2 marks)

- 6 (b) (i)** Suggest why, despite their higher embodied energy, replacing steel with aluminium and plastics may reduce the total amount of energy used by a car over its lifetime.

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(2 marks)



- 6 (b) (ii)** Outline how car manufacturers can design cars to reduce the environmental impact at the end of the vehicle's life.

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(2 marks)

- 6 (c)** Use examples to explain how the purchasing choices made by consumers can affect the overall environmental impact of their lifestyle.

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(4 marks)

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7 Read the article and then answer the questions that follow.

The photograph shows an Environmental Education Centre that was designed to have a low environmental impact, both in its construction and during use.



Wherever possible, local products and recycled materials were used such as wood from nearby plantations and bricks made of compressed earth blocks rather than kiln-fired clay. Power station ash was used to reduce cement use. Other post-consumer waste materials were used where possible, such as worktops made of recycled yoghurt pots. The materials used above the ground were also chosen so that they could be reused in the future if the building was no longer required. Any imported wood is certified by the Forest Stewardship Council (FSC) and no tropical timber was used.

It has been estimated that the use of large double glazed windows, on the walls that face south and on the roof, has resulted in an annual passive solar gain of 4000 kWh, which reduces the space heating needs by about 20%. The conservatory also increases passive solar gains. The compressed earth floor has a high thermal capacity which prevents overheating during sunny weather and reduces the need for additional heating during colder weather.

The photothermal panel on the roof provides about 50% of the hot water that is used.

Window orientation means virtually no artificial lighting is required during the day and, when it is required, the use of high efficiency fluorescent lights reduces the electricity used for lighting by a further 28%.

The walls and floors have a very low thermal conductivity as they have thicker insulation than most modern buildings. Recycled paper fibres and the wool of British sheep were used as the insulating materials.

Heat loss is also reduced by the use of heat exchangers. This heat recovery reduces the energy loss caused by ventilation in winter.

About 120 000 litres of rainwater that drain off the upper roof each year are collected and stored for general cleaning use and for the low-flush toilets. The lower roofs are covered in turf to compensate for the loss of habitat caused by building the Education Centre. The turf absorbs water and releases it slowly which reduces storm surges after heavy rain.



The building is not joined to the main sewage system. When the toilets are flushed, the waste enters a waste separator. Fluids drain into a woodland where bacteria in the soil break down wastes and plants absorb the nutrients. The water replenishes the aquifer. Solid wastes enter a chamber where they biodegrade and produce compost which is used later as a fertiliser for tree planting projects.

The materials used in the building should cause little pollution if it caught fire, as there is little use of plastics, synthetic paints and heavy metals.

- 7 (a)** Suggest why using materials from local sources reduces the environmental impact of building construction.

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(2 marks)

- 7 (b)** Use an example to give another reason why the choice of building material can reduce pollution emissions.

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(2 marks)

- 7 (c)** Outline how the use of solar power reduces the use of other energy inputs.

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(3 marks)

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7 (d) Explain how double glazed windows reduce heat losses.

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(3 marks)

7 (e) Describe how the Education Centre's management of water reduces its environmental impact.

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(5 marks)

15



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Handwriting practice area with 20 horizontal dotted lines.



(20 marks)

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