Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

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

General Certificate of Education
Advanced Level Examination
June 2014

Environmental Studies ENVS3

Unit 3 Energy Resources and Environmental Pollution

Wednesday 4 June 2014 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 pollution control methods.

Complete **Table 1** by adding **one** example of a pollutant that can be treated by each control method.
Two rows have been completed for you.

[5 marks]

Table 1

Pollution control method	**One pollutant treated by the method**
Dry flue gas	Sulfur dioxide
Urea spray	
Electrostatic precipitator	
Baffle mound	Noise
Bacterial remediation	
Tertiary sewage treatment	
Vitrification	

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Turn over for the next question

2 The future contribution of different energy resources to the overall energy supply will partly depend on the development of efficient new technologies.

2 (a) Explain how tertiary recovery of oil increases the recovery rate.

[2 marks]

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2 (b) Outline the advantages of using in-stream tidal turbines instead of tidal barrages.

[2 marks]

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2 (c) Describe how improvements in technology have increased the amount of energy that can be harnessed using:

2 (c) (i) wind power

[2 marks]

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2 (c) (ii) photovoltaic **and** photothermal solar power.

[4 marks]

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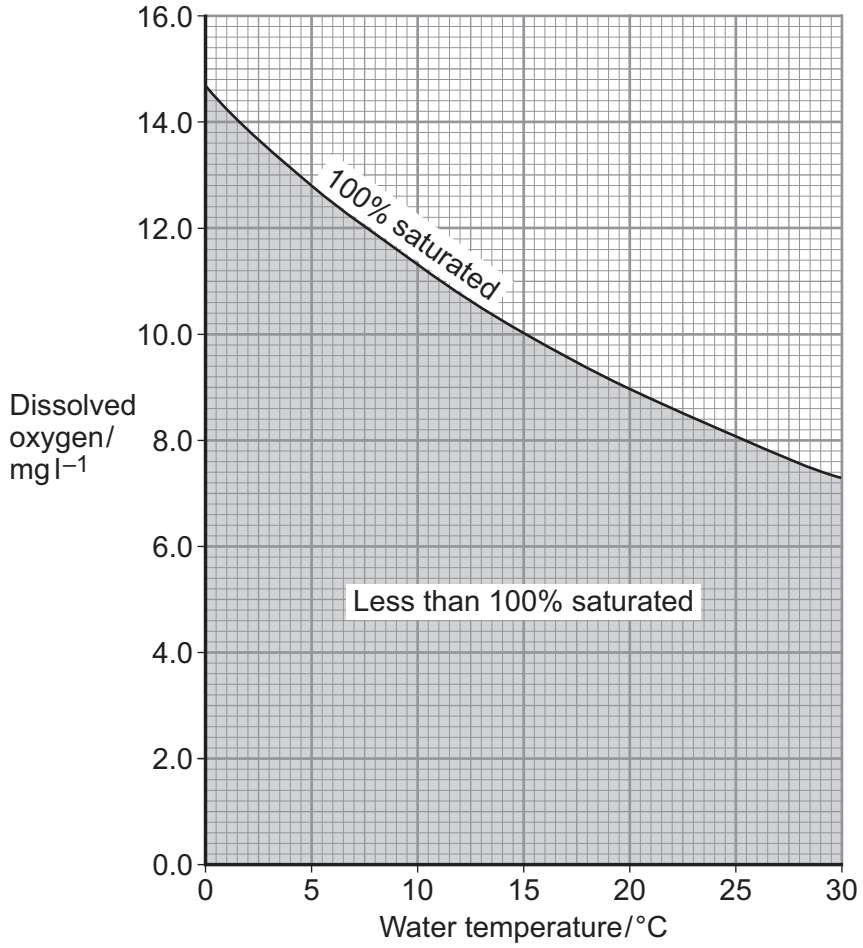
Turn over for the next question

3 **Figure 1** shows the maximum amount of oxygen that can dissolve in water at different temperatures.

Figure 1



3 (a) Use **Figure 1** to estimate the amount of oxygen that will come out of solution if the temperature of 1 litre of 100% saturated water at 5 °C rises to 20 °C.

[1 mark]

……**mg**

3 (b) Young Sockeye Salmon die if dissolved oxygen levels drop below 8.1 mg l^{-1}.

Use **Figure 1** to estimate the highest water temperature at which they can survive.

[1 mark]

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3 (c) Describe **one** method that is used at power stations to reduce the temperature of effluent water.

[2 marks]

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3 (d) Pollution caused by inorganic nutrients or sewage effluent may also lower dissolved oxygen levels in water.

Outline the similarities **and** differences between pollution caused by inorganic nutrients and that caused by sewage effluent.

[6 marks]

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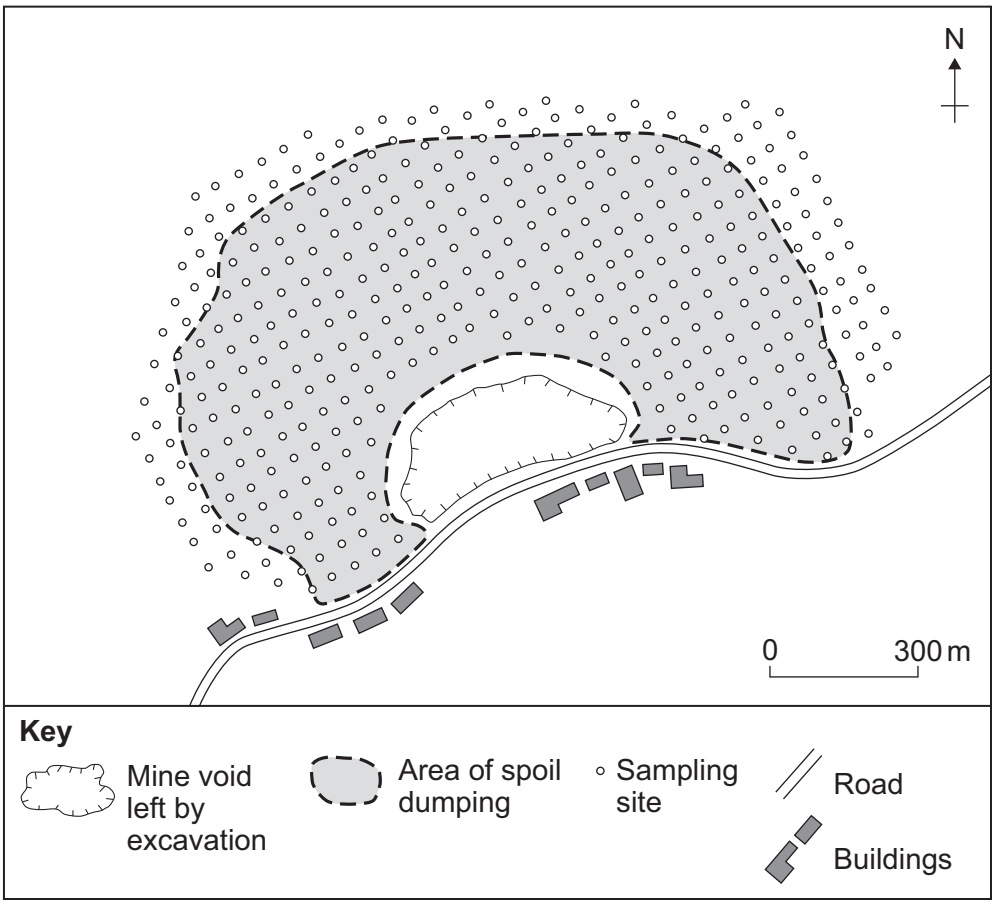
4 **Figure 2** shows the area around an old open-cast lead mine and the sampling sites in a study of soil contamination.

Figure 2



It was expected that there would be considerable variation in the results for different parts of the area, with some localised higher concentrations.

4 (a) Suggest how a preliminary study may have been used to select a suitable distance between sample sites.

[1 mark]

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Question 4 continues on the next page

Turn over ▶

4 (b) Suggest how the collection of soil samples may have been standardised.

[2 marks]

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4 (c) In an experimental area, phytoremediation of the contamination was attempted using plants that absorb lead. If the plants absorbed and concentrated the lead, they could be harvested and disposed of in a location where the lead would not cause pollution.

Table 2 shows the lead content in the dry biomass of the harvested plants.

Table 2

Plant number	Lead content / mg lead per kg of plant tissue	
	Plant species A	Plant species B
1	60.5	70.4
2	65.9	60.2
3	70.2	70.9
4	58.4	66.3
5	67.5	69.2
6	69.4	72.1
7	63.0	61.7
8	72.1	68.4
9	66.3	74.0
10	64.2	68.1
Mean	**65.75**	**68.13**
Standard deviation	**4.325**	**4.145**

4 (c) (i) What information is provided by calculating the standard deviation?

[1 mark]

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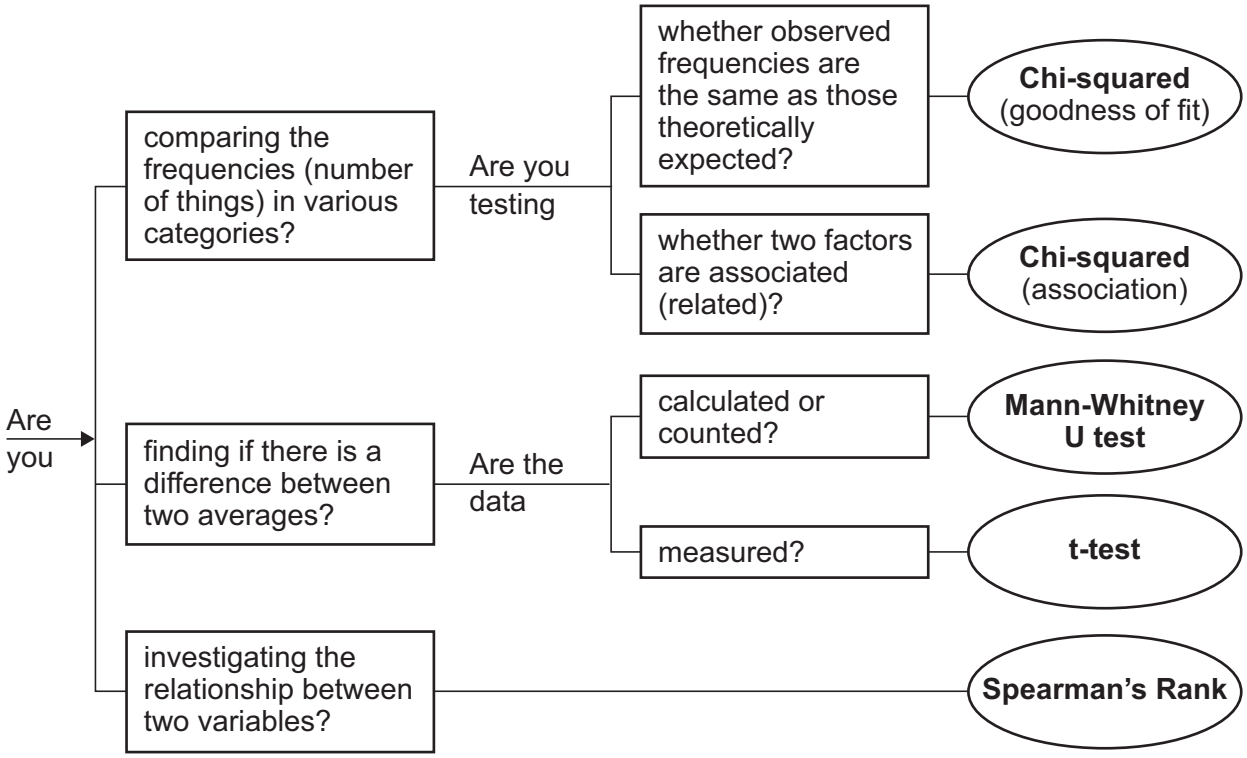
4 (c) (ii) Use the flow diagram (**Figure 3**) to select a suitable test to see whether there is a statistically significant difference between the results for the two plant species.

Figure 3



Tick (✓) **one** box to show which statistical test you have chosen.

[1 mark]

Chi-squared (goodness of fit) ☐

Chi-squared (association) ☐

Mann-Whitney U Test ☐

t-test ☐

Spearman's Rank ☐

Turn over ▶

4 (d) Outline how, other than by phytoremediation, the risk of lead contamination of local rivers may be reduced.

[3 marks]

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4 (e) Why would there be cause for concern if lead entered public drinking water supplies, even at low levels?

[2 marks]

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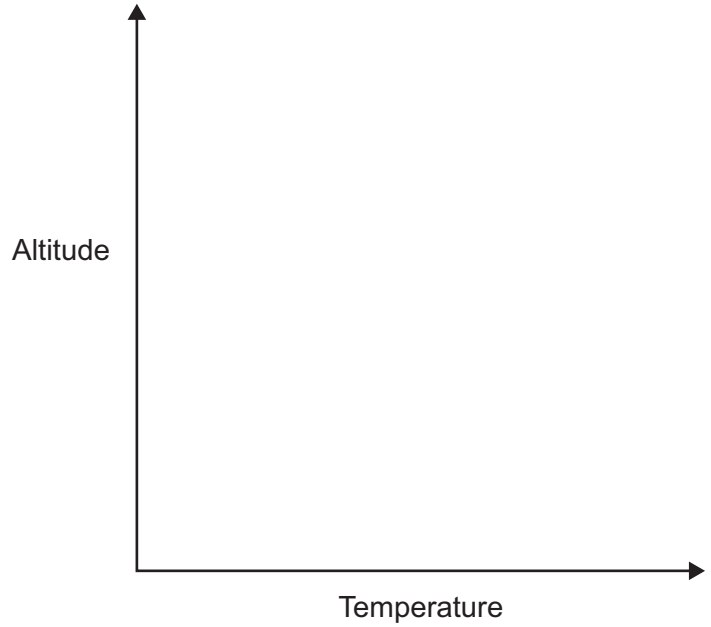
5 **Figure 4** is an outline graph that may be used to show the changes in temperature with increasing altitude during a temperature inversion.

Figure 4



5 (a) Complete **Figure 4** to show conditions during a temperature inversion.

[1 mark]

5 (b) Describe the factors that make it more likely that a temperature inversion will occur.

[3 marks]

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5 (c) Outline the differences between smoke smogs and photochemical smogs.

[5 marks]

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5 (d) Suggest how the production of a **named** pollutant, other than smoke, may be reduced by the use of a **named** secondary fuel.

[1 mark]

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Turn over for the next question

6 **Figure 5** shows photothermal solar panels and **Figure 6** shows a tank which stores the hot water produced for later use.

Figure 5

Photothermal solar panels

Figure 6

Hot water tank

The volume of a heat store affects the rate at which heat is lost from the store.

Describe an experiment to investigate the effect of volume on the rate of heat loss.

[5 marks]

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Turn over for the next question

7 **Figures 7**, **8**, **9** and **10** show information about selected energy resources.

Figure 7

Photovoltaic panels

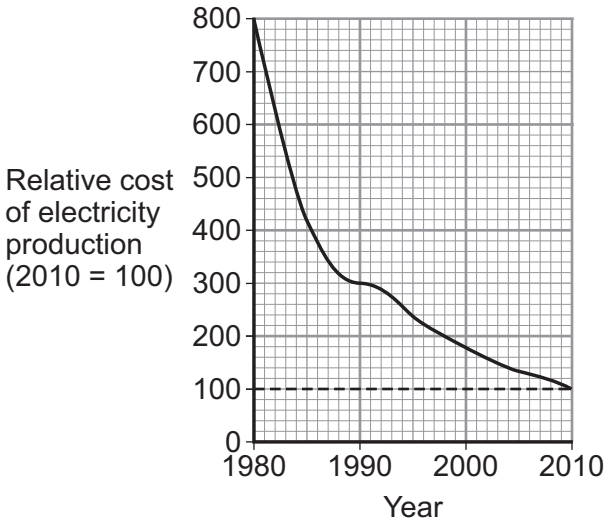


Figure 8

Cost of generating electricity by different methods in 2010

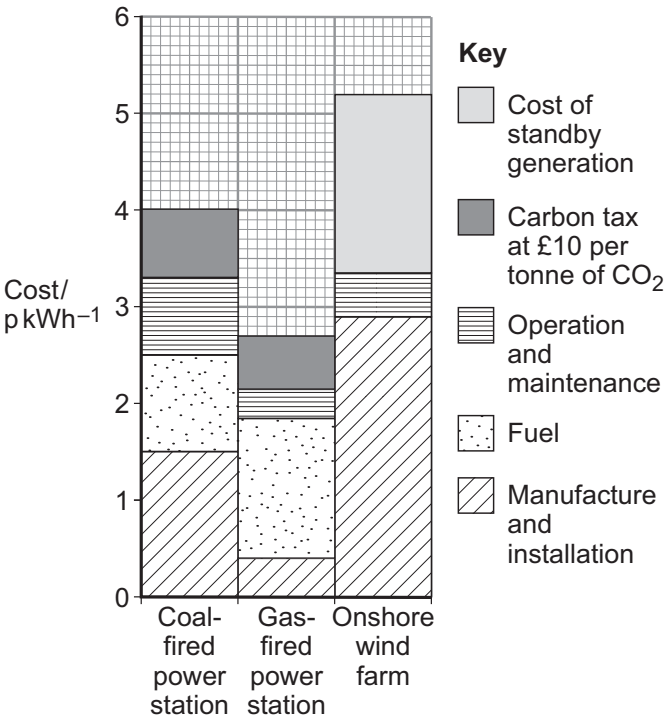


Figure 9

Global maximum output of photovoltaic solar power

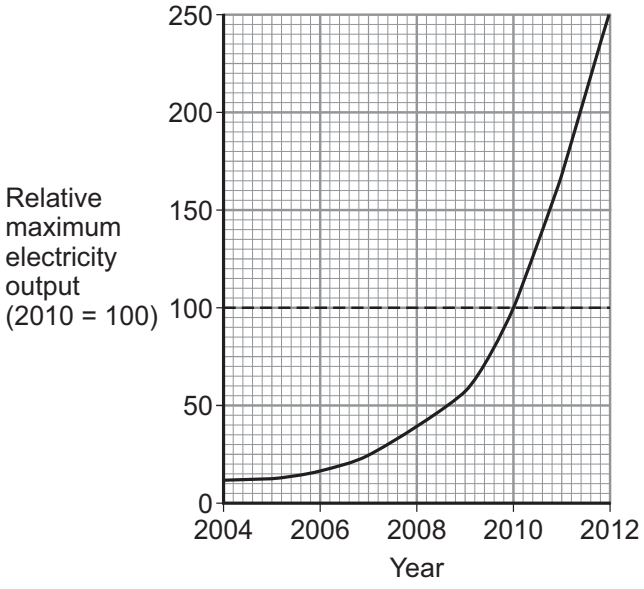
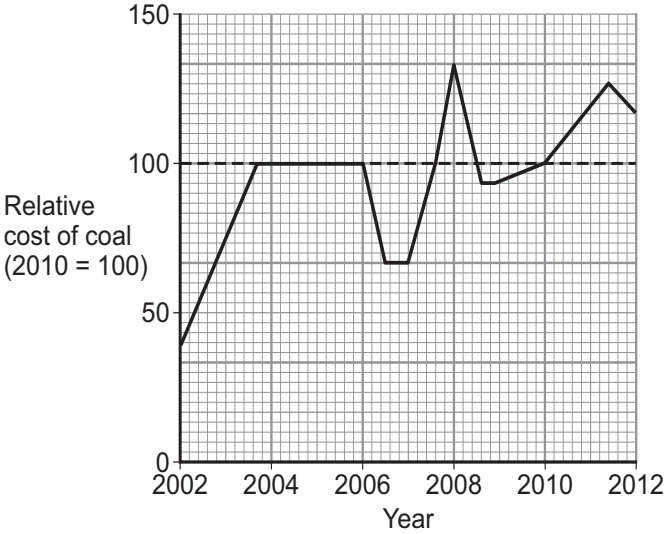


Figure 10

Long-term coal price 2002 – 2012



7 (a) Use the information in **Figures 7**, **8**, **9** and **10** to suggest:

7 (a) (i) why governments decided to provide financial subsidies to the photovoltaic industry
[3 marks]

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7 (a) (ii) why subsidies will not be needed in the long term.
[1 mark]

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7 (b) Suggest why costs for standby generation in **Figure 8** are only included for windpower.
[1 mark]

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Question 7 continues on the next page

7 (c) Suggest how the economic competitiveness of energy resources would be affected if the full economic costs of environmental impacts were included.

[5 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 extent to which recycling materials reduces environmental damage.

[20 marks]

or

8 (b) Explain how changes in vehicle design may reduce the environmental impact during the use and final disposal of the vehicles.

[20 marks]

or

8 (c) Explain how good house design may reduce the amount of energy needed to produce a suitable internal temperature.

[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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