

Centre No.						Paper Reference (complete below)					Surname	Initial(s)	
Candidate No.									/				Signature

Paper Reference(s)

**6103/03**

**Edexcel GCE**

**Biology**

**Biology (Human)**

**Advanced Subsidiary**

**Unit Test 3 Paper 03**

**Tuesday 8 June 2004 – Morning**

**Time: 1 hour**

Examiner's use only

--	--	--

Team Leader's use only

--	--	--

Question Number	Leave Blank
1	
2	
3	
Total	

**Materials required for examination**

Ruler

**Items included with question papers**

Nil

**Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname and initials, the paper reference and your signature. The paper reference is shown above.

Check that you have the correct question paper.

Answer ALL THREE questions in the spaces provided in this booklet.

Show all the steps in any calculations and state the units. Calculators may be used.

Include diagrams in your answers where these are helpful.

**Information for Candidates**

The marks for individual questions and parts of questions are shown in round brackets: e.g. (2).

The total mark for this question paper is 38.

**Advice to Candidates**

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

This publication may only be reproduced in accordance with London Qualifications Limited copyright policy.  
©2004 London Qualifications Limited.

Printer's Log. No.

**N18605A**



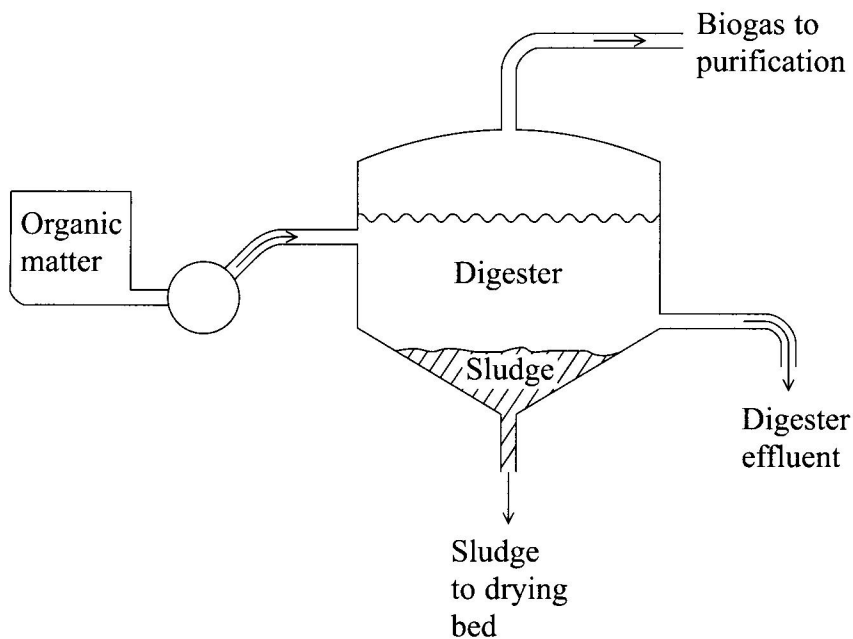
W850/R6103/57570 7/71

**Turn over**

**Edexcel**  
Success through qualifications

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

1. The diagram below shows a system that can be used to produce biogas from waste organic matter.



- (a) Name the main component of biogas.

..... (1)

- (b) Suggest how biogas is produced from the organic matter in the digester.

.....  
.....  
.....  
..... (2)

- (c) State **one** use of biogas.

..... (1)

- (d) Suggest **one** agricultural use of the sludge removed from the digester after it is dried.

..... (1)

**(Total 5 marks)**

Q1

2. The plant family Papilionaceae includes many important crop plants. These are known as legume crops. A common agricultural practice when growing legume crops is to spray the seed with a solution containing bacteria. This solution is known as an inoculant. The inoculant contains bacteria of the genus *Rhizobium*. It is important that the species of *Rhizobium* used in the inoculant is specific to the legume crop (Figure 1).

**Figure 1 – The species of *Rhizobium* that is used in the inoculant for some legume crops.**

Legume crop	Species of <i>Rhizobium</i> in inoculant
Alfalfa	<i>R. meliloti</i>
Field bean	<i>R. phaseoli</i>
Faba bean	<i>R. leguminosarum</i>
Soybean	<i>R. japonicum</i>
Chickpea	<i>R. ciceri</i>

Field trials have been conducted in the USA to assess the effect of using *Rhizobium* inoculants upon the yield of soybean crops. In the trials, soybean crops were grown with the addition of an inoculant. The yields of these crops were compared with those from crops grown without the addition of an inoculant. The trials were conducted on open sites in five regions. The sites had equal areas. The yield of soybeans was measured by volume. The results of the trial are shown in Figure 2.

**Figure 2 – The results of the field trials showing the effect of using *Rhizobium* inoculants on the yield of soybeans.**

Test region	Yield per test site without inoculant /dm <sup>3</sup>	Yield per test site with inoculant /dm <sup>3</sup>	Increase in yield per test site /dm <sup>3</sup>	% Increase in yield per test site
Minnesota	1519	1569	50	3.3
Missouri	1631	1669	38	2.3
South Dakota	1652	1769	117	7.1
Iowa	1831	1844	13	0.7
Ohio	1887	1953		

- (a) The relationship between *Rhizobium* and a legume crop is an example of mutualism. Explain what is meant by the term **mutualism**.

.....

.....

.....

.....

(b) State which species of bacterium would have been in the inoculant used in the field trials.

..... (1)

(c) Complete the table in Figure 2 for Ohio. (2)

(d) Explain why the addition of the *Rhizobium* inoculant to the soybean crops in the field trials increased the yield of beans.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... (4)

(e) (i) Compare the effect of the addition of the inoculant in South Dakota and Iowa.

.....  
.....  
.....  
..... (2)

(ii) Suggest a reason for the difference you have described.

.....  
..... (1)

**BLANK PAGE**

(f) (i) Suggest **one** reason why the yield of the beans was measured using volume rather than by counting the individual beans.

.....  
..... (1)

(ii) Suggest **one** reason why it might have been better to measure yields of soybeans by mass rather than by volume.

.....  
..... (1)

(Total 14 marks)

Q2

3. The digestive processes of ruminant animals produce the gases methane and carbon dioxide. A study was carried out in Virginia, USA, to determine the methane and carbon dioxide emissions from cattle and sheep. The results of this study are shown in Figure 1 below.

**Figure 1 – Table showing the emissions of methane and carbon dioxide from cattle and sheep in 1990 and 1996.**

	Methane emissions /tonnes year <sup>-1</sup>		Carbon dioxide emissions/tonnes year <sup>-1</sup>	
	1990	1996	1990	1996
Beef cattle	45 897	52 626	126 217	144 723
Dairy cattle	11 537	10 108	31 727	29 144
Sheep	976	672	2 628	1 848
Total	58 410	63 406	160 572	175 715
% Increase	—	8.6	—	—

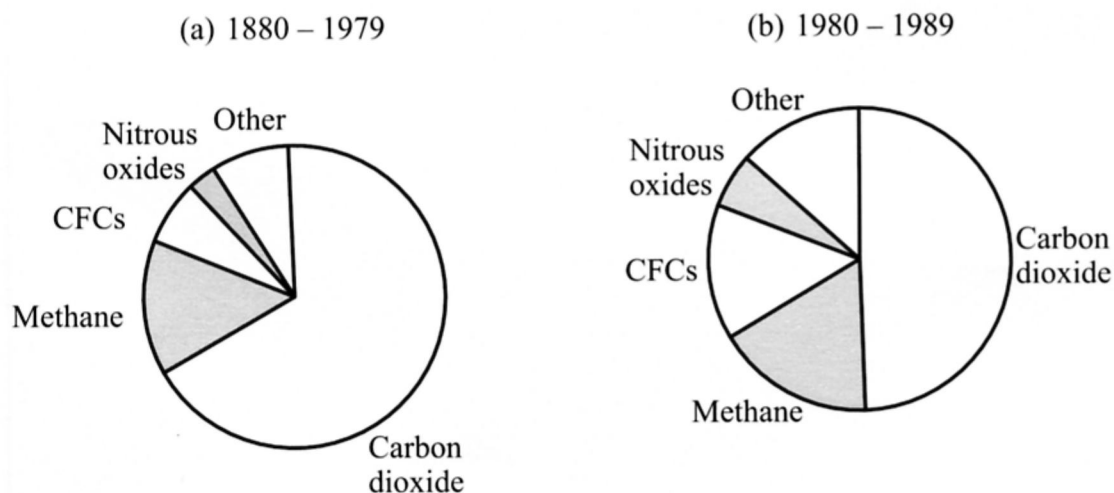
Both methane and carbon dioxide are greenhouse gases. Greenhouse gases vary in their potential warming effect. Figure 2 shows the global warming potential (GWP) of greenhouse gases relative to carbon dioxide.

**Figure 2 – Table comparing the global warming potential of four greenhouse gases.**

Greenhouse gas	Global Warming Potential (GWP)
Carbon dioxide	1
Methane	21
Nitrous oxide	206
CFC-11	3400

The percentage contribution of the different greenhouse gases to global warming has changed since 1880. These changes are shown in Figure 3.

**Figure 3 – Pie charts showing the percentage contribution of different greenhouse gases to global warming.**



(a) Describe how cellulose in grass is digested in a ruminant animal.

.....  
.....  
.....  
.....  
.....  
.....

(3)

(b) Using the data in Figure 1, calculate the percentage increase in the carbon dioxide emissions between 1990 and 1996. Show your working.

Answer .....

(2)

(c) Describe the changes in the emissions of methane and carbon dioxide between 1990 and 1996 as shown in Figure 1. Suggest reasons for these changes.

.....  
.....  
.....  
.....  
.....  
.....  
.....

(3)

(d) The digestive processes of ruminant animals are not the only sources of methane and carbon dioxide in the atmosphere. State **one** other source of each of these gases in the atmosphere.

Methane .....

Carbon dioxide .....

(2)



**BLANK PAGE**

(e) Explain the importance of greenhouse gases in the atmosphere and explain how a change in the concentration of these gases can lead to global warming.

.....  
.....  
.....  
.....  
.....  
.....

(3)

(f) Using the information provided in Figure 2, explain how an increase in methane concentration in the atmosphere can have more effect than the same increase in carbon dioxide concentration.

.....  
.....  
.....  
.....

(2)

(g) Carbon dioxide emissions increased after 1980.

(i) Explain why the percentage contribution of carbon dioxide to global warming **decreased** as shown in Figure 3.

.....  
.....

(1)

(ii) Explain how human activities could have been responsible for the changes since 1980 in methane, CFCs and nitrous oxides, as shown in Figure 3.

.....  
.....  
.....  
.....  
.....  
.....

(3)

(Total 19 marks)

Q3

TOTAL FOR PAPER: 38 MARKS

END