Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						7	0	4	0	/	0	2	Signature	

Paper Reference(s)

7040/02

London Examinations GCE

Biology

Ordinary Level

Paper 2

Friday 18 January 2008 – Afternoon

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
The paper is arranged in THREE sections, A, B and C.
In Section A, answer ALL questions.
In Section B, answer any TWO questions.
In Section C, answer any TWO questions.
Write your answers in the spaces provided in this question paper.
Indicate which question you are answering by marking the box (☒). If you change your mind, put a line through the box (~~☒~~) and then indicate your new question with a cross (☒).

Information for Candidates

Calculators may be used.
The total mark for this paper is 100.
The marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 11 questions. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.

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SECTION A

Answer ALL questions in this section.

1. Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Applications of gene therapy

Gene therapy has been used to relieve the symptoms of some inherited conditions, such as cystic fibrosis. This condition is caused by a recessive allele, which produces abnormally thick mucus in the small tubes of the lungs. Microorganisms live and grow in the mucus and lung infections may occur. Antibiotics can be taken to reduce the infections.

Gene therapy for this condition involves using a spray containing special viruses. These viruses have been genetically modified to deliver the normal allele to the cells that produce mucus in the lungs. The viruses act as vectors for recombinant DNA. This viral DNA contains the normal human allele and, once it is inside the lung cells, normal mucus is made. Unfortunately the allele stops working after a few weeks and the symptoms of the condition may return.

Children with another condition called severe combined immunodeficiency (SCID) have also been helped by gene therapy. Children with SCID have inherited an allele that produces a toxin that destroys white blood cells. The children are unable to defend themselves against pathogenic microorganisms. Such children have to be protected by living in a ‘bubble’, a transparent container designed to keep harmful microorganisms out.

Gene therapy for SCID children involves several steps. First, a restriction enzyme is used to isolate the normal allele from healthy cell DNA. The normal allele is then put into a virus, which then injects the normal allele into young white blood cells taken from the child. The genetically modified young white blood cells are put back into the child. Here they divide to produce a supply of cells that can protect the child.

Leave blank

(a) Using the letter **G** for the dominant allele and **g** for the recessive allele, explain how two unaffected parents can produce a child with cystic fibrosis.

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(3)

(b) Name the type of microorganism that would live and grow in the sticky lung mucus. (line 3)

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(1)

(c) Explain what is meant by **recombinant DNA**. (line 8)

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(2)

(d) Suggest **one** symptom that may be shown by people with cystic fibrosis. (line 11)

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(1)

(e) What is meant by the term **pathogenic**? (line 15)

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(1)

Leave blank

(f) Name **two** types of white blood cell and explain how each type protects the body against pathogenic microorganisms.

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(4)

(g) Suggest what needs to be done to the air before it enters the 'bubble' protecting children with SCID. (line 16)

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(2)

(h) What type of cell division occurs in the genetically modified young white blood cells? (line 21)

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(1)

Q1

(Total 15 marks)

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2. Describe an investigation you could carry out to determine the effect of a chemical fertiliser on the growth of a cereal crop.

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Q2

(Total 6 marks)

Leave blank

3. The table below shows the volume of oxygen found in the lungs and carried in the blood of humans and some aquatic mammals.

Mammal	Volume of oxygen in cm^3 per kg of body mass	
	In lungs	**In blood**
Human	10	10
Dolphin	13	10
Sperm whale	3	32
Weddell seal	8	40

(a) (i) Which mammal has the highest total volume of oxygen in the lungs and in the blood per kg body mass?

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(1)

(ii) What volume of oxygen would there be in the blood of a 50 kg human?

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..... cm^3

(1)

(iii) What proportion of oxygen is contained in the blood of a sperm whale compared to the total contained in the lungs and the blood? Give your answer as a percentage.

Answer ..... %

(2)

Leave blank

(b) Describe how oxygen gets from the lungs into the blood of a mammal.

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(3)

(c) Dolphins swim mainly near the surface. Weddell seals and sperm whales, however, can dive to a depth of 600 metres and stay underwater for an hour. Suggest how the volumes of oxygen in their lungs and in their blood helps them to do this.

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(3)

Q3

(Total 10 marks)

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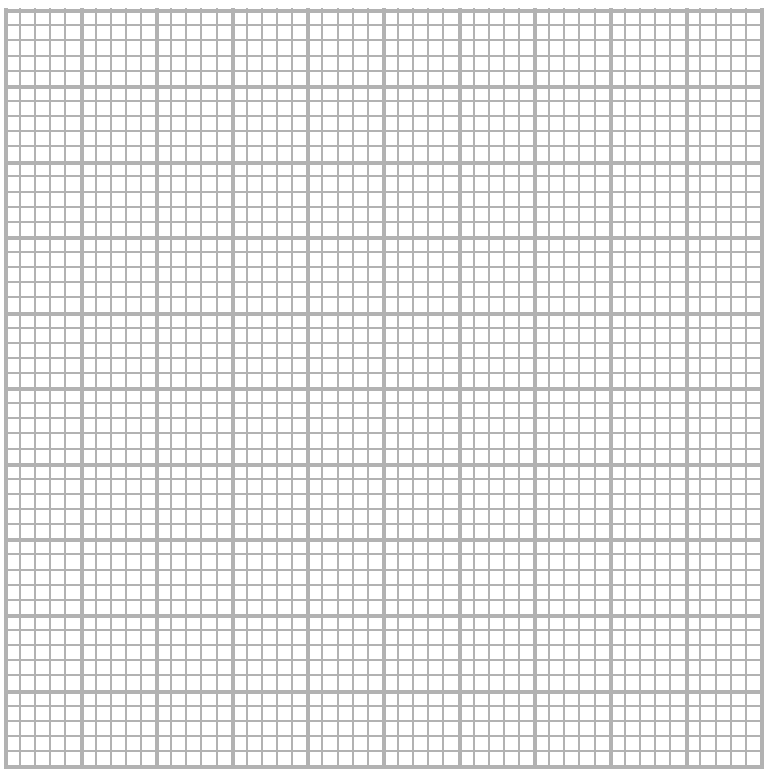
4. The table below shows how the width of the stomata and the wind speed can affect the rate of transpiration from a leaf of a plant. The widths are measured in micrometres (μm).

Width of stomata in μm	**Rate of transpiration in g per m^2 per hour**	
	In still air	**In wind**
0	0.0	0.0
5	1.8	3.6
10	2.2	5.4
15	2.3	7.2
20	2.5	9.0

(a) (i) On the grid below, plot lines to show how the rate of transpiration in still air and in wind varies with different widths of stomata. Join the points with straight lines.



(6)

(ii) Use your graph to predict the rate of transpiration in still air when the stomata have a width of 8 μm.

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(1)

Leave blank

(iii) Describe the relationship between the width of stomata and the rate of transpiration in still air.

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(b) Explain why the rate of transpiration in wind differs from the rate in still air.

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(c) Explain why transpiration is important in plants.

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Q4

(Total 17 marks)

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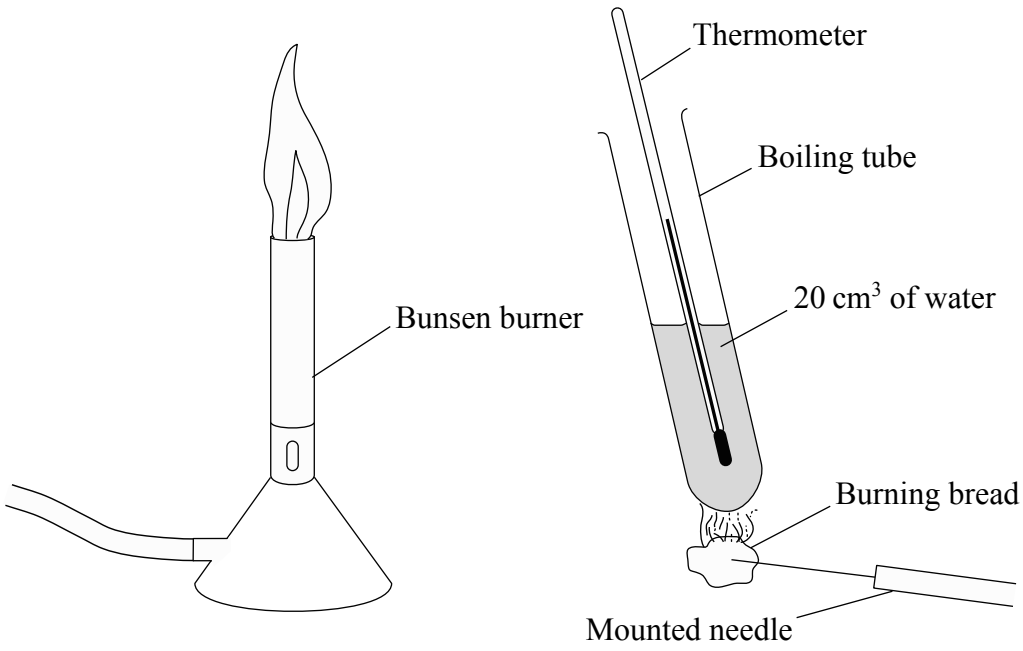
5. Bethany used the apparatus shown below to measure the energy content of a piece of dried bread.



The temperature of the water in the boiling tube at the start was 15 ºC and the mass of the bread was 0.4 g. Bethany placed the bread on the mounted needle, lit the bread in the Bunsen flame then moved it as quickly as possible and held it under the boiling tube. After the bread had completely burned, the temperature of the water was 38 ºC.

(a) (i) Explain why the temperature of the water in the boiling tube increased during the experiment.

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(2)

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(ii) Why did Bethany move the bread 'as quickly as possible' from the Bunsen flame to the boiling tube?

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(1)

(b) Bethany used the following equation to calculate the energy content of the bread.

$$\text{Energy of bread in kJ} = \frac{\text{mass of 20 cm}^3 \text{ of water} \times 4.2 \times \text{temperature rise in } ^\circ\text{C}}{1000}$$

(i) Use this equation to calculate the energy present in the piece of bread.
(20 cm^3 of water has a mass of 20 g)

Answer ..... kJ

(2)

(ii) The piece of bread that Bethany used had a mass of 0.4 g. From her results, how much energy would there be in 100 g of the bread?

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(1)

Leave blank

(c) Bethany looked at the energy value of the bread as given on the nutritional information on the packet. This gave the energy value of the bread as 992 kJ per 100 g.

(i) Suggest why this value is different from the answer you calculated from Bethany's data.

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(ii) Suggest **two** ways that Bethany could modify her experiment and for each way explain how it would improve her results.

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Q5

(Total 12 marks)

TOTAL FOR SECTION A: 60 MARKS

Leave blank

SECTION B

Answer TWO questions in this section. If you change your mind, put a line through the box (☒) and then indicate your new question with a cross (☒).

Where appropriate you may draw diagrams to make your answer clearer.

If you answer Question 6, put a cross in this box ☒.

6. (a) Describe how plant nutrition differs from animal nutrition.

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(b) Plants can reproduce by asexual reproduction, while animals rarely reproduce asexually. Explain why asexual reproduction does not increase the amount of variation in offspring.

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(5) **Q6**

(Total 8 marks)

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If you answer Question 7, put a cross in this box ☒.

7. (a) What is meant by the terms **stimulus**, **receptor** and **effector**?

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(b) Describe how the structures in the eye change when a person views a distant object after reading a book.

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(5) **Q7**

(Total 8 marks)

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If you answer Question 8, put a cross in this box ☒.

8. (a) Compare the processes of selective breeding and genetic modification.

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(b) Explain what is meant by transgenic animals and evaluate their potential use.

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(4) **Q8**

(Total 8 marks)

TOTAL FOR SECTION B: 16 MARKS

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SECTION C

Answer TWO questions in this section. If you change your mind, put a line through the box (☒) and then indicate your new question with a cross (☒).

Where appropriate you may draw diagrams to make your answer clearer.

If you answer Question 9, put a cross in this box ☒.

9. Describe and explain what would happen to a piece of bread and butter from when it is first eaten to when its digested molecules are absorbed into the blood. In your answer refer only to the digestion of starch and lipid.

Leave blank

Q9

(Total 12 marks)

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If you answer Question 10, put a cross in this box ☒.

10. Describe and explain the biological consequences of air pollution. In your answer you should refer to the sources and effects of named gases.

Leave blank

Q10

(Total 12 marks)

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If you answer Question 11, put a cross in this box ☒.

11. Describe and explain how the human kidney is involved in excretion and how it regulates the concentration of the blood.

Leave blank

Q11

(Total 12 marks)

TOTAL FOR SECTION C: 24 MARKS

TOTAL FOR PAPER: 100 MARKS

END

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