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

Wednesday 6 May 2009 – Morning

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
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8	
9	
10	
11	
12	
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.
Do not use Pencil. Use blue or black ink.
In Sections B and C, 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 marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 12 questions in this question paper. The total mark for this paper is 100.
There are 28 pages in this question paper. 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.

Biochemical Oxygen Demand (BOD)

BOD is a measure of the rate at which oxygen is used in a sample of water. Polluted water has a higher BOD than unpolluted water. This is because polluted water normally contains more organic material and also more aerobic micro-organisms. The organic material is often in the form of sewage.

A simple method can be used to calculate the BOD. A sample of water is taken and its oxygen concentration is measured in mg per litre using an oxygen meter. The sample is then left in the dark for 5 days at 20 °C. After this time, the oxygen concentration is measured again. The BOD is then calculated from the equation below.

BOD = original O_2 concentration – final O_2 concentration

The more oxygen used up over the 5 days the higher the BOD. The higher the BOD, the more polluted the water is. It is illegal to allow water to become polluted and have a BOD higher than 20. The table shows some typical BOD values measured in different types of water.

type of water	BOD mg per litre
clean	3
polluted	10
containing treated sewage	20
containing raw sewage	300

Eutrophication can also produce high BOD values with catastrophic effects on the fish and other large, active organisms living in the water. Fortunately, an aquatic ecosystem can slowly recover from the high BOD values caused by eutrophication. This is because oxygen slowly diffuses into the water from the air.

However, in the long term, eutrophication can be prevented by reducing the amount of minerals leaching into the water. This can be achieved in several ways, for example, by controlling the amount of inorganic fertiliser that is applied. It can also be achieved by using organic fertilisers, low-phosphate detergents, and removing soluble minerals by precipitation in modern sewage plants. As a last resort, eutrophic lakes can be dredged (dug out) to remove mineral-rich sediment (mud), but this is expensive and it takes a long time for the ecosystem to recover. Nevertheless this has been done successfully in the Norfolk Broads in England.

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(a) State **two** reasons, given in the passage, why water can become polluted and so have a high BOD.

1 .....

2 .....

(2)

(b) Suggest how aerobic micro-organisms would affect the BOD value in polluted water.

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(1)

(c) (i) Name the process that uses up the oxygen in the sample during the five days (lines 5 to 7).

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(1)

(ii) Suggest why the water sample is kept in the dark when calculating BOD (line 7).

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(2)

(iii) Suggest why the water sample is kept at 20 °C when calculating BOD (line 7).

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(2)

(iv) Which type of water named in the table has a BOD above the legal limit?

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(1)

Leave blank

(d) Suggest what is meant by the term ‘aquatic ecosystem’ (lines 20 to 21).

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(2)

(e) Suggest why large, active organisms are more at risk than small, less active organisms in water with a high BOD.

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(2)

(f) Describe the main events responsible for producing a high BOD as a result of eutrophication (line 19).

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(2)

(g) Suggest **one** way in which the application of inorganic fertiliser can be controlled (line 25).

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(1)

(h) Suggest **one** reason why it takes a long time for the ecosystem to recover if the mud is dredged (line 28).

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(1)

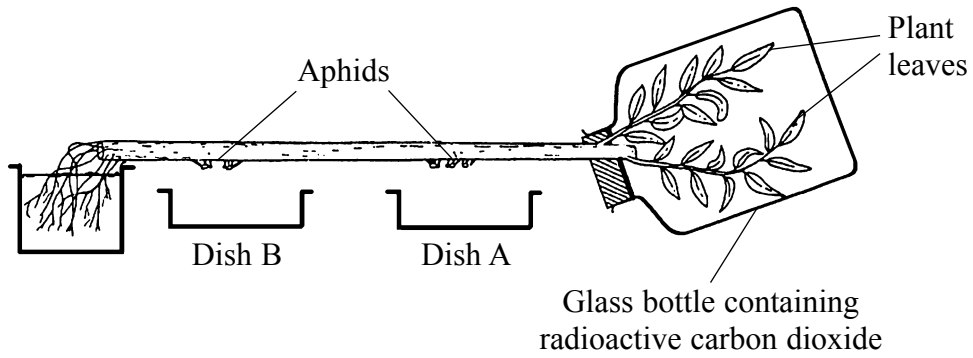
Q1

(Total 17 marks)

Leave blank

2. Aphids are insects that feed by sucking sucrose out of plant stems. They suck large quantities and often not all the sucrose can be absorbed by the aphid's gut. Excess sucrose is egested. This is the basis of a method that can be used to measure the rate of sucrose transport from plant leaves to their roots.

The diagram below shows apparatus that can be used in an investigation to measure the rate of sucrose transport.



Radioactive carbon dioxide is given to plant leaves. The leaves carry out photosynthesis and the sucrose made is radioactive. This is first detected in the sucrose egested by the aphids above dish A. It is later egested by the aphids above dish B. The time when radioactive sucrose appears on each dish can be measured and used to calculate the rate of sucrose transport.

The table shows the results from three trials in an investigation using this method.

Trial	Distance between aphids at A and B in cm	Time taken for radioactive sucrose to travel from A to B in minutes	Rate of sucrose transport in cm per hour
1	66	120	33
2	34	85	24
3	66	180	**?**

(a) Calculate the rate of sucrose transport in trial 3. Show your working.

Answer ..... cm per hour
(2)

Leave blank

(b) To make the results of this investigation valid it is important to control certain variables.

(i) Name **one** variable that affects the rate of photosynthesis and must be kept at the same level.

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(1)

(ii) Suggest **one** factor in relation to the aphids that needs to be the same above each dish.

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(1)

(c) (i) Name the tissue that transports sucrose.

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(1)

(ii) Suggest why sucrose is transported to the roots of plants.

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(1)

Q2

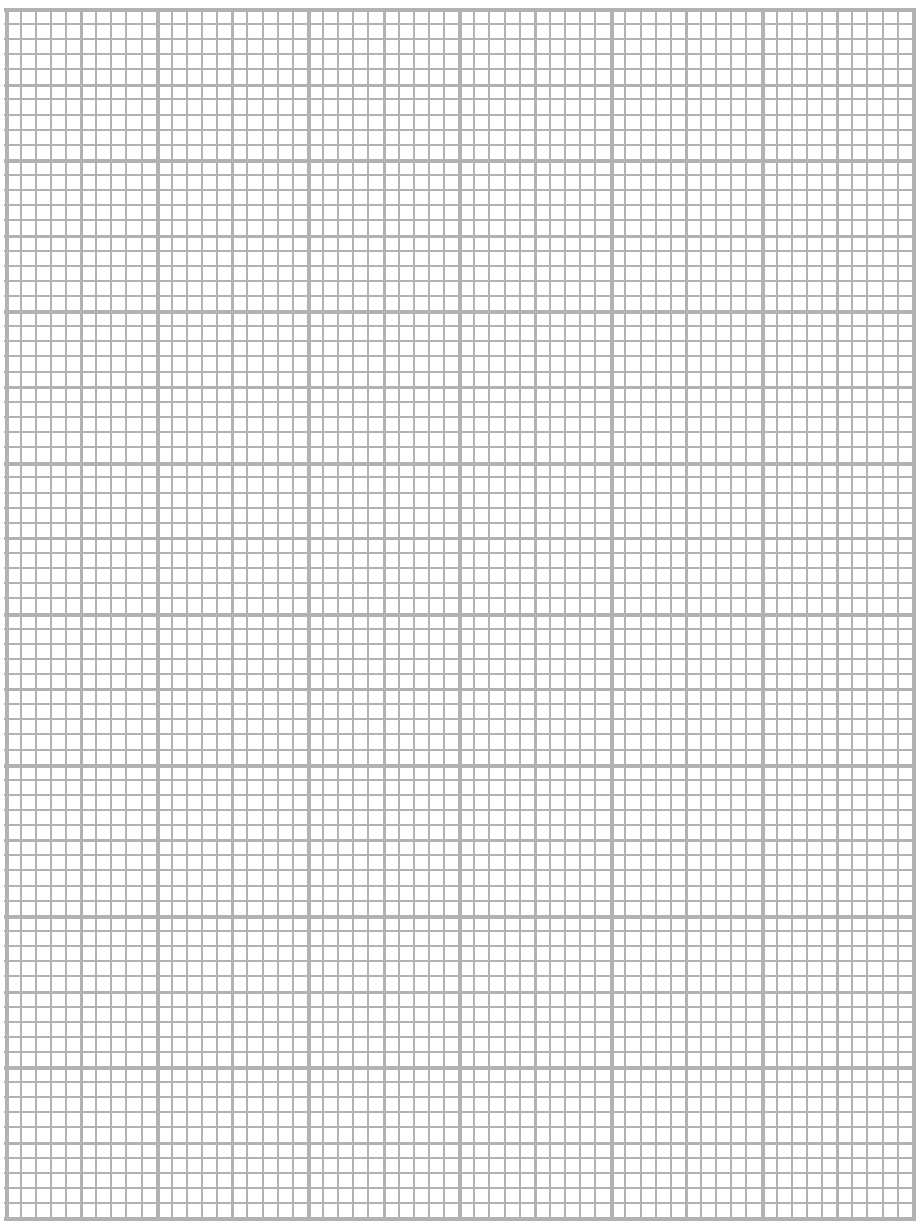
(Total 6 marks)

Leave blank

3. Five surveys were carried out over a forty year period in the USA to determine the percentage of children who were overweight. The surveys included children in two different age ranges: those 6 to 11 and those 12 to 19. The table below shows the results.

Age of children in years	**Percentage of children classified as overweight at each survey**				
	1963 to 1970	**1971 to 1974**	**1976 to 1980**	**1988 to 1994**	**1999 to 2002**
6 to 11	4	4	7	11	16
12 to 19	5	6	5	11	16

(a) (i) On the grid below, plot a bar graph to show these data.



(5)

Leave blank

(ii) Use your graph to describe the changes in the percentage of children who are classified as overweight in the 6 to 11 age range.

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(2)

(iii) Suggest **two** reasons for the changes in percentage of children who are overweight in the 6 to 11 age range.

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(2)

(b) If the children in the 12 to 19 age range continue to increase in mass they may become obese. Explain the harmful effects of obesity on the body.

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(2)

(c) Obesity is a problem usually associated with developed countries. Give an example of a nutritional problem more often associated with developing countries.

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(1)

(Total 12 marks)

Q3

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4. Describe an investigation to find out how sulphur dioxide affects the germination of seeds.

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(Total 5 marks)

Q4

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5. Gerard set up an experiment to look at how gas exchange in animals and plants can change the concentration of carbon dioxide in different conditions.

He set up three tanks (A, B and C) each containing 500 cm^3 of water. He placed three water snails into tank A. He placed two *Elodea* plants (water plants) into tank B. He placed three water snails and two *Elodea* plants into tank C. To each tank he added a small quantity of hydrogencarbonate indicator. He left the tanks in bright sunlight for 6 hours.

Hydrogencarbonate indicator changes colour with different levels of carbon dioxide.

- in high levels of carbon dioxide the indicator is yellow
- in medium levels of carbon dioxide the indicator is orange
- in low levels of carbon dioxide the indicator is dark red

(a) The table below shows the experiment set up. Complete the table to show the colours of the indicator at the start and the end.

Tank	Contents	Colour of indicator at start	Colour of indicator at end
A	Snails	orange	
B	*Elodea*		
C	Snails and *Elodea*		

(4)

(b) Gerard left the tanks in the dark for 12 hours overnight, then returned to look at them. He noticed that the colour of the indicator in tank B was yellow. Explain this observation.

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(2)

Leave blank

(c) The human lung surface is adapted for efficient gas exchange. State **two** ways in which the lungs are adapted and explain how each adaptation improves gas exchange.

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(4)

(Total 10 marks)

Q5

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6. The table below shows some data about mammals and their mass, heart rate, lifespan and the number of heartbeats in their lifetime.

Animal	Mass in kg	Heart rate in beats per minute	Lifespan in years	Lifetime heartbeats (billions)
Hamster	0.06	450	3	0.71
Rabbit	1	205	9	0.97
Cat	2	150	15	1.18
Dog	5	90	15	0.71
Monkey	5	190	15	1.5
Horse	800	44	40	0.93
Giraffe	1200	65	20	0.68
Elephant	5000	30	70	1.1

(a) Describe the relationship between mass and lifespan.

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(1)

(b) (i) Describe the relationship between mass and heart rate.

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(1)

(ii) Suggest a reason for this relationship.

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(1)

(c) Name **one** other factor that influences heart rate and state its effect.

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(2)

Leave blank

(d) It has been suggested that an animal's heart can only carry out a fixed number of heart beats in its lifetime. Explain whether these data support this suggestion.

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(3)

(e) For humans, the total number of heartbeats in a lifetime is 2.21 billion.

Suggest an explanation why the human has a higher total than any of the other animals.

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(2)

Q6

(Total 10 marks)

TOTAL FOR SECTION A: 60 MARKS

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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 (☒).

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

7. (a) Describe the similarities and differences between diffusion and osmosis.

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(4)

(b) When an area is flooded, water fills the air spaces in the soil. Explain why this can reduce crop yield.

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(4)

Q7

(Total 8 marks)

Leave blank

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

8. (a) Distinguish between each of the following genetic terms.

(i) Homozygous and heterozygous

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(2)

(ii) Complete dominance and codominance

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(2)

(iii) Genotype and phenotype

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(2)

(b) Explain the possible consequences of a mutation that causes a bacterium to be resistant to a particular antibiotic.

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(2) **Q8**

(Total 8 marks)

Leave blank

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

9. (a) How does communication using nerves differ from communication using hormones?

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(4)

(b) Seedlings grown in the dark are taller than those grown in the light. The first leaves are yellow in colour and the seedlings soon die. Explain these observations.

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(4) **Q9**

(Total 8 marks)

TOTAL FOR SECTION B: 16 MARKS

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TURN OVER FOR SECTION C

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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 (☒).

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

10. Describe and explain how the components of the blood help protect the body against infection.

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 structure of a leaf is adapted for efficient photosynthesis.

Leave blank

(Total 12 marks)

Q11

Leave blank

If you answer Question 12, put a cross in this box ☒ .

12. A person swallowed a painkiller to relieve a severe headache. The painkiller consisted of a powder contained in a protein capsule. Describe how the chemicals in the powder were able to reach the person's brain.

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Q12

(Total 12 marks)

TOTAL FOR SECTION C: 24 MARKS

TOTAL FOR PAPER: 100 MARKS

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