

**ADVANCED GCE****BIOLOGY**

Unifying Concepts in Biology

2806/01

Candidates answer on the question paper

OCR Supplied Materials:

- Insert (inserted)

Other Materials Required:

- Electronic calculator
- Ruler (cm/mm)

Thursday 29 January 2009**Afternoon****Duration:** 1 hour 15 minutes

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	16	
2	16	
3	16	
4	12	
TOTAL	60	

Answer **all** the questions.

- 1 (a) Plants belonging to the family Gramineae (grasses) are common throughout the world.

Grasses that grow in temperate climates show an unusual biochemical feature. Instead of storing energy as amylose (starch), they store energy as fructans, which are polymers of the hexose sugar fructose.

Complete Table 1.1 to show the differences between a fructan molecule and an amylose molecule.

Table 1.1

	fructan	amylose (starch)
hexose sugar monomer	fructose	
number of subunits in polymer	200	
type of glycosidic bond	β 1–2	
solubility in water	soluble	
storage organelle	vacuole	

[5]

- (b) Outline the biochemical steps by which a plant can make fructan, beginning with carbon dioxide, ATP and reduced NADP (NADPH₂) in the Calvin cycle.

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..... [4]

- (c) (i) It has been suggested that fructans help plants withstand stresses, such as drought. To test this, genetically modified (GM) tobacco plants were produced that could make and store fructans. Wild type tobacco plants do not make and store fructans.

Explain what is meant by a 'genetically modified (GM) tobacco plant'.

.....
 [1]

Table 1.2 shows the effects of drought on the gain in dry mass of GM and wild type tobacco plants.

Table 1.2

plant	mean dry mass gain / g	
	control conditions	drought conditions
wild type tobacco	4.4	2.9
GM tobacco	4.8	4.4

- (ii) Using the figures for the plants in **drought conditions**, calculate the percentage improvement in mean dry mass of GM tobacco plants compared with wild type tobacco plants.

Answer = % [2]

- (iii) Explain why the experiment measured dry mass as a measure of growth rather than fresh mass.

.....

 [2]

- (d) Wild ponies used to occur naturally in mountain and moorland areas of Britain. These habitats have nutrient-poor soils. Many of these ponies are now kept in fertile lowland areas, where they sometimes develop a disease called laminitis, linked to eating too much fructan.

Suggest why mountain and moorland breeds of pony may be particularly susceptible to laminitis.

.....

 [2]

[Total: 16]
Turn over

- 2 (a) Four poisonous organisms are shown in Fig. 2.1, **on the insert**. Each organism makes a poison that affects the functioning of synapses between nerve cells.

Use your observations of Fig. 2.1 and your knowledge of classification to fill in the empty spaces in Table 2.1, writing on the dotted lines.

Table 2.1

	kingdom	phylum	.....	.....
A	Animalia	Chordata	<i>Arothron</i>	<i>nigropunctatus</i>
B	.....	Mollusca	<i>Conus</i>	<i>textile</i>
C	.....	Anoxybacteria	<i>Clostridium</i>	<i>botulinum</i>
D	.....	Angiospermophyta	<i>Physostigma</i>	<i>venenosum</i>

[5]

- (b) The poisons made by the four organisms affect the functioning of animal synapses in four different ways. Table 2.2 summarises the action of each poison.

Table 2.2

	source of poison	action of poison
A	<i>Arothron</i>	blocks sodium channels
B	<i>Conus</i>	blocks calcium channels
C	<i>Clostridium</i>	prevents exocytosis
D	<i>Physostigma</i>	inhibits the enzyme acetylcholinesterase

Blank lined paper for writing.

[Total: 16]

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- 3 (a) Fig. 3.1 shows the relationship between intake of fish in the diet and the incidence of deaths from heart disease in men in seven countries in 1986.

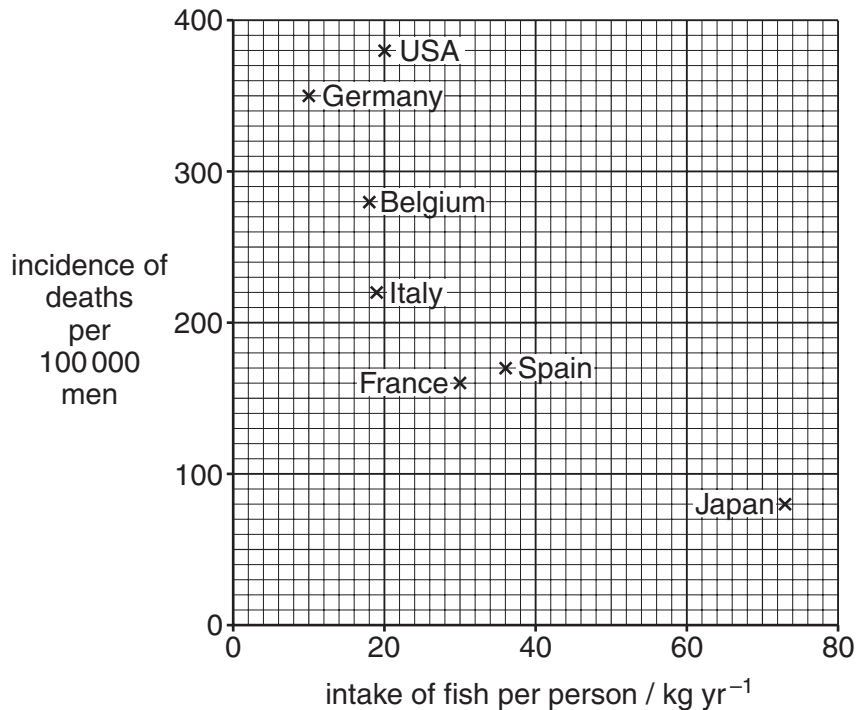


Fig. 3.1

- (i) Draw a line of best fit on Fig. 3.1 to illustrate the trend shown by the data. [1]
- (ii) Using Fig. 3.1, describe the relationship between intake of fish and the incidence of deaths from heart disease in men.
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-
-
- [2]
- (iii) People in Belgium, Italy and the USA have similar intakes of fish but quite different incidences of deaths from heart disease.

Suggest, with reasons, which of the three data points could be an anomaly.

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..... [2]

- (b) The epidemiological link between intake of fish and heart disease is thought to be due to the presence of certain fatty acids called omega-3 fatty acids. These are polyunsaturated fatty acids, consisting of a carboxylic acid group (COOH) attached to a hydrocarbon chain. They always have a carbon-carbon double bond (C=C) between the 3rd and 4th carbons at the methyl (CH₃) end of the hydrocarbon chain.

Using your knowledge and the information given, draw the structure of an omega-3 fatty acid.

[2]

- (c) Experiments have been conducted where two groups of people were given **either** extra fish in their diet **or** capsules containing purified fish oils. The fish and the purified fish oils both contained omega-3 fatty acids.

The blood pressure and the speed of blood clotting were then measured in the two groups of people at regular intervals.

- (i) Explain, with reasons, whether the experiment that uses extra dietary fish **or** the experiment that uses capsules is a better method of testing the effect of omega-3 fatty acids on cardiovascular health, as measured by blood pressure and speed of blood clotting.

.....

 [2]

- (ii) Given the relationship shown in Fig. 3.1, predict the effects of higher omega-3 fatty acid intake on blood pressure and the speed of blood clotting.

.....

 [2]

- (d) Studies show that there is a correlation between cardiovascular disease and depression. Patients with cardiovascular disease are more likely to become depressed. Similarly, patients with depression are more likely to develop cardiovascular disease.

Suggest how the lifestyle of a patient with depression might put him or her more at risk of developing cardiovascular disease.

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 [2]

- (e) Fig. 3.2 shows the relationship between intake of fish in the diet and the percentage of the population with depression in seven countries in 1998.

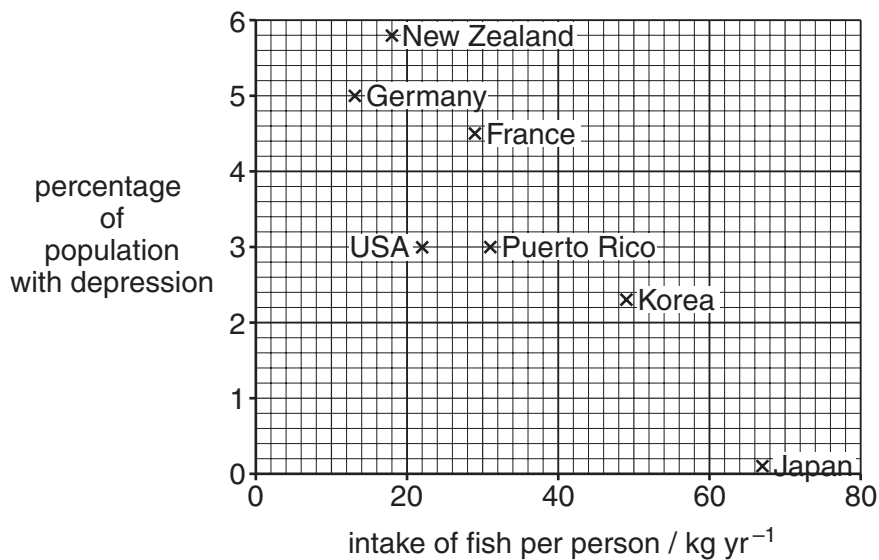


Fig. 3.2

- (i) Suggest why the intakes of fish for the countries shown on **both** Figs. 3.1 and 3.2 (France, Germany, Japan, USA) are **not** identical on the two graphs.

.....

 [1]

- (ii) In (d) it was suggested that the lifestyle of patients with depression might make them more at risk of developing cardiovascular disease.

Use Fig. 3.2 to evaluate the hypothesis that the correlation between depression and cardiovascular disease is solely due to the lifestyle of a patient with depression.

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..... [2]

[Total: 16]

- 4 (a) The North American beaver, *Castor canadensis*, is an important species within its ecosystem. Beavers chop down trees, mainly species that can show a coppice growth pattern such as aspen, poplar and willow. They use these trees to build dams, which alter the water flow of streams to create ponds and wetlands. This activity of beavers helps to reduce flooding downstream and promotes biodiversity.

Beaver dams also trap silt which reduces soil erosion and decreases the cloudiness of the water. Nitrate and phosphate fertiliser concentrations in the water are also reduced, since the cellulose-digesting bacteria that thrive in the dam extract these nutrients from the water.

- (i) State what is meant by a tree with a *coppice growth pattern*.

.....
 [1]

- (ii) State the term used to describe the damaging sequence of events that can occur when high levels of nitrates and phosphates enter streams.

..... [1]

- (iii) Use the information about the ecology of the beaver to suggest **and** explain how the abundance of **two** types of organism could be affected by the introduction of beavers to an area of forest.

1

 [2]

2

 [2]

- (b) The purpose of the beaver's dam is to create a large pond. Here, the beavers use trees and branches to construct an island on which they build their winter home. This winter home has thick walls of branches and mud, and all the entrances to it are deep underwater. In the places where beavers live, the water around their home freezes solid for many months in winter.

The beaver collects a store of food underwater to last the winter. This consists of twigs and logs, from which the bark, phloem and cambium are eaten.

- (i) Explain how **one** physical property of water benefits the beaver in its attempts to protect itself from predators during the winter.

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..... [3]

- (ii) Suggest why the beaver eats the outer part of a twig but not the xylem.

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..... [2]

- (c) A typical sequence of events for a newly-felled forest area in Canada is described below.

After logging, aspen trees regenerate and within 8 to 10 years provide a suitable habitat for beavers. Beavers move in and use up the aspen within about three years, but the increased moisture and nutrient conditions resulting from the beavers' dam-building activity allow willow trees to grow. These then provide the beaver colony with food and building materials.

State the name of the ecological process occurring here.

..... [1]

[Total: 12]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Acknowledgements:

Table 1.2	Source: Pilon-Smits et al, <i>Improved Performance of Transgenic Fructan-Accumulating Tobacco under Drought Stress</i> , Plant Physiol, 1995
Fig. 3.1	Source: R Rice, The Fish Foundation, Tiverton, UK, www.fish-foundation.org.uk
Fig. 3.2	Hibbeln JR, <i>Fish consumption and major depression</i> , Lancet 1998

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