



88056005

BIOLOGY
STANDARD LEVEL
PAPER 2

Thursday 10 November 2005 (afternoon)

1 hour 15 minutes

Candidate session number

0	0							
---	---	--	--	--	--	--	--	--

INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.



SECTION A

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

- 1. Potatoes with more starch have a lower percentage water content. This has an advantage in the transport, cooking and processing of potatoes.

In a strain of *Escherichia coli* scientists found an enzyme which increases the production of starch. Using biotechnology, the gene for this enzyme was transferred to potatoes, increasing their starch content (transgenic potatoes). The gene was transferred to three potato varieties to create three transgenic lines. The table shows the mean amount of starch and sugar contained in three lines of transgenic potatoes and normal potatoes (control), after storage for four months at 4 °C.

Potato	Line	Carbohydrate / % of fresh weight	
		Sugar	Starch
Transgenic	I	0.60	11.07
	II	1.56	11.61
	III	1.46	12.74
	Mean	1.21	11.81
Control	I	5.14	5.88
	II	5.61	3.70
	III	4.32	6.35
	Mean	5.02	5.31

[Source: Stark *et al.*, (1999), *Annals of the New York Academy of Sciences*, **792**, pages 26–36]

- (a) State which line of transgenic potato has the greatest amount of starch. [1]

.....

- (b) (i) Compare the levels of carbohydrate between the transgenic lines and the control potatoes. [2]

.....

- (ii) Suggest reasons for these differences. [2]

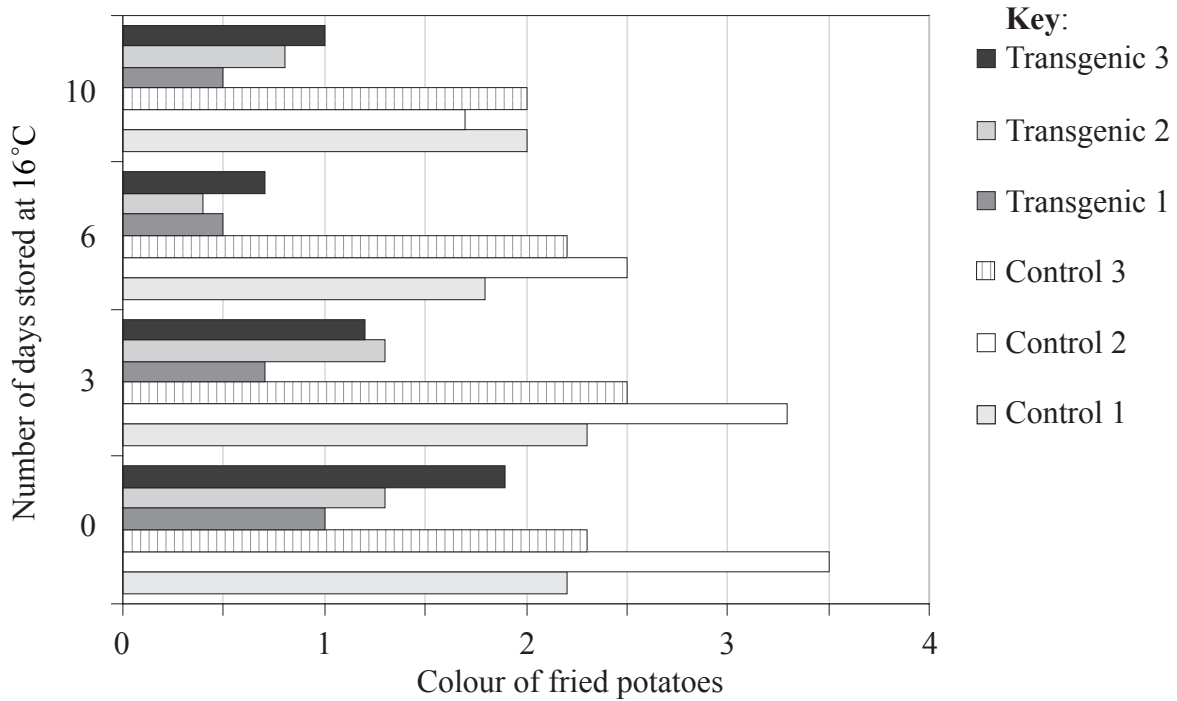
.....

(This question continues on the following page)



(Question 1 continued)

Potato tubers were harvested from the field and stored in high humidity at 4 °C for three months. After this period, the tubers were stored at 16 °C, and samples were removed after 0, 3, 6 or 10 days, cut into strips, and fried. The colour of the fried potatoes was then measured and values reported using a 0–4 rating (light to dark), where a score of 2 or lower indicates acceptable colour. The results are shown in the table.



[Source: Stark *et al.*, (1999), *Annals of the New York Academy of Sciences*, 792, pages 26–36]

(c) Evaluate the effect of transferring the *E. coli* gene on the suitability of the potatoes for frying. [2]

.....

.....

.....

.....

.....

.....

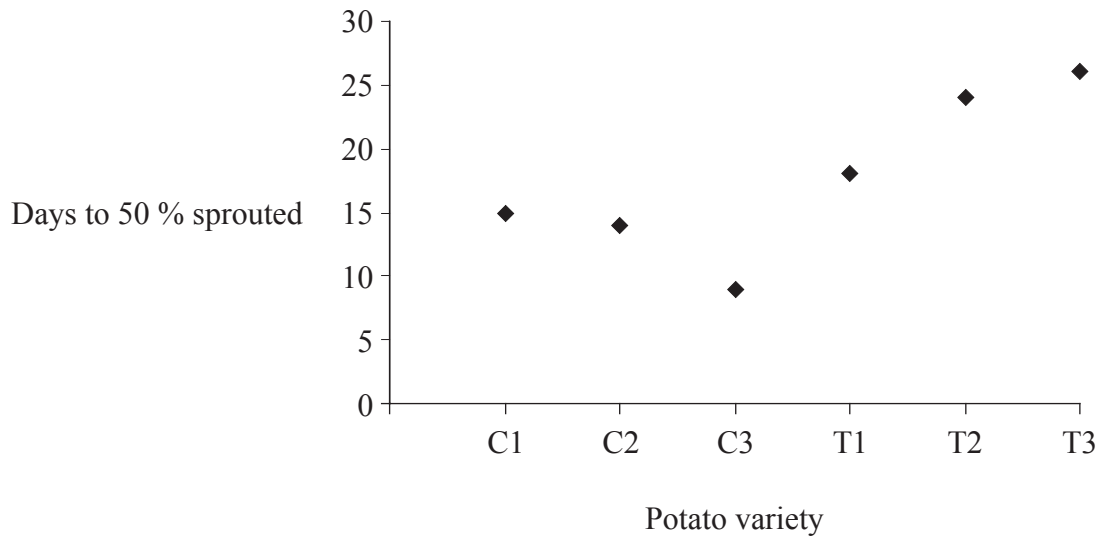
.....

(This question continues on the following page)



(Question 1 continued)

An important part of storage management is to delay sprouting of potatoes. A second sample of potatoes was harvested from the field and stored at high humidity for three months at 4°C. Storage temperature was then raised to 16°C and a sample of potatoes were examined daily and scored for the number of sprouts longer than 0.5 cm. The number of days it took for 50 % to sprout is indicated in the graph for control varieties (C1, C2 and C3) and three transgenic varieties (T1, T2 and T3) of potatoes.



[Source: Stark *et al.*, (1999), *Annals of the New York Academy of Sciences*, 792, pages 26–36]

(d) Deduce how the *E. coli* gene affects the storage of potatoes. [2]

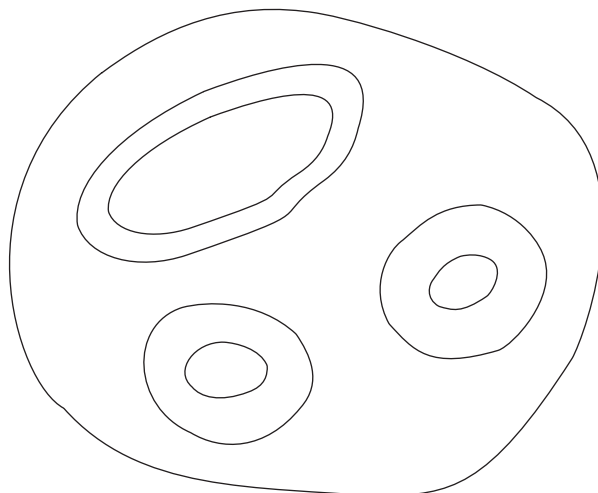
.....
.....
.....
.....

(e) Discuss **three** possible harmful effects of genetically modified potatoes. [3]

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



2. The umbilical cord connects the fetus to the mother during pregnancy. The following is a drawing of a cross section of an umbilical cord.



(a) (i) Annotate the drawing above to show an artery. [1]

(ii) Briefly explain the structural features which lead to your choice above. [2]

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

(b) The umbilical vein carries substances from the mother to the embryo. State **two** of these substances. [2]

.....
.....

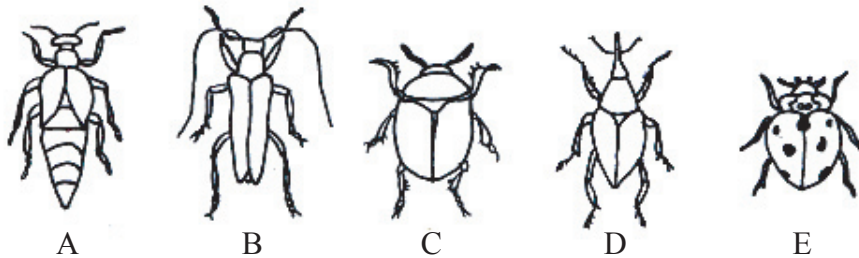
(c) The umbilical cord is joined to the placenta. Throughout pregnancy the placenta secretes hormones. Changes in the levels of these hormones control the timing of birth. Oxytocin, a hormone which is not produced by the placenta, is also involved in the process of birth. Briefly describe the role of oxytocin. [2]

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

3. The following is a dichotomous key for a group of beetles.

- | | | |
|----|------------------------------|-----------------|
| 1. | Wing cases with spots | Ladybird |
| | Wing cases without spots | 2 |
| 2. | Elongated head | Weevil |
| | Head not elongated | 3 |
| 3. | Long antennae | Longhorn beetle |
| | Short antennae | 4 |
| 4. | Wing cases shorter than body | Oil beetle |
| | Wings cases as long as body | Colorado beetle |

(a) Using the key, identify the following beetles. [2]



- A:
- B:
- C:
- D:
- E:

(b) In an ecological study to estimate the population size of Colorado beetles, 20 beetles were captured and marked. These were released soon after. A few days later, 10 beetles were recaptured, five of which were marked. Estimate the size of the population of Colorado beetles. Show your working. [2]

.....

.....

.....

.....

4. (a) Animal and plant cells can be seen under light and electron microscopes. Complete the chart below using a tick (✓) for observation and a cross (×) when this observation is not possible using this type of microscope. [3]

Observation of	Type of microscope	
	Light microscope	Electron microscope
Chloroplasts		
Large vacuole		
Virus		
Movement of cilia		
Lysosomes		
Cell wall		

- (b) In cells there are many processes that involve enzyme-catalyzed reactions. Respiration is one of them.

- (i) In the cytoplasm of the cell, glucose is broken down into pyruvate in a process called glycolysis. State **one** product of glycolysis. [1]

.....

- (ii) Explain how a substrate attaches to an enzyme. [3]

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



SECTION B

*Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

5. (a) Draw a labelled diagram of the ventilation system of humans. [4]
- (b) Describe the need for a ventilation system. [6]
- (c) Tuberculosis is a disease of the ventilation system. Explain how white blood cells attack the pathogens that cause this disease. [8]
6. (a) Draw the structure of a generalized dipeptide, showing the peptide linkage. [4]
- (b) Describe how the properties of phospholipids help to maintain the structure of cell membranes. [6]
- (c) Explain how substances may pass into cells through the membrane. [8]
7. (a) Draw a labelled graph showing the sigmoid (S-shaped) population growth curve. [4]
- (b) Explain the differences in the way energy and nutrients are transferred within ecosystems. [8]
- (c) Outline measures which would reduce the impact of the greenhouse effect. [6]
-

