Rewarding Learning

Centre Number	
71	

Candidate Number

ADVANCED
General Certificate of Education
January 2010

Biology

Assessment Unit A2 3A

assessing

Module 6A: Synoptic Paper

[A2B31]

A2B31

THURSDAY 28 JANUARY, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all four** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Section A carries 35 marks.
Section B carries 15 marks.
You should spend approximately **20 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A **data sheet** is provided for use with this paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
Total Marks	

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Section A

Examiner Only	
Marks	Remark

1 A changing environmental temperature is a major problem for ectothermic animals. However, the impact of this has been reduced in many ectotherms through the use of behavioural means to adjust their internal temperature.

(a) Describe how an ectotherm might respond to

- an increase in environmental temperature

_____

_____

- a decrease in environmental temperature

_____

_____ [2]

While many insects are obviously ectothermic – for example, butterflies only fly when it is sunny – there is evidence that honeybees (*Apis mellifera*) have developed some endothermic responses.

(b) The honeybee needs a body temperature of 35 °C to be able to fly effectively. On cool days, the bees vibrate or shiver their wings for some minutes until the required temperature in their flight muscles is reached.

(i) Explain how the shivering response of the honeybee generates heat in the flight muscles.

_____

_____

_____

_____ [2]

(ii) Explain why the honeybee's flight muscles would need to be maintained at a high temperature (35 °C) for the insect to be able to fly.

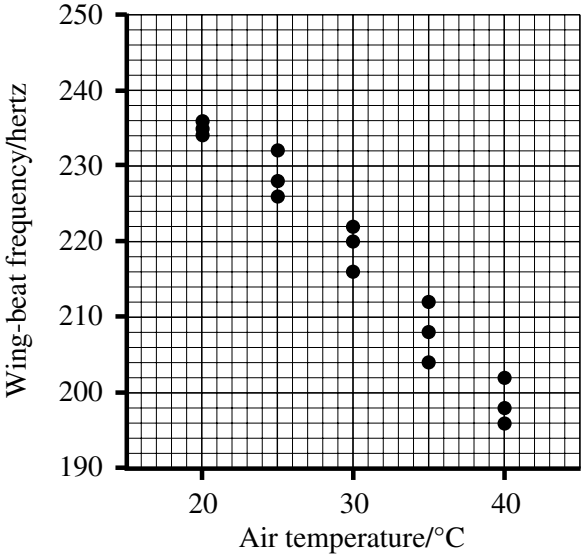
_____

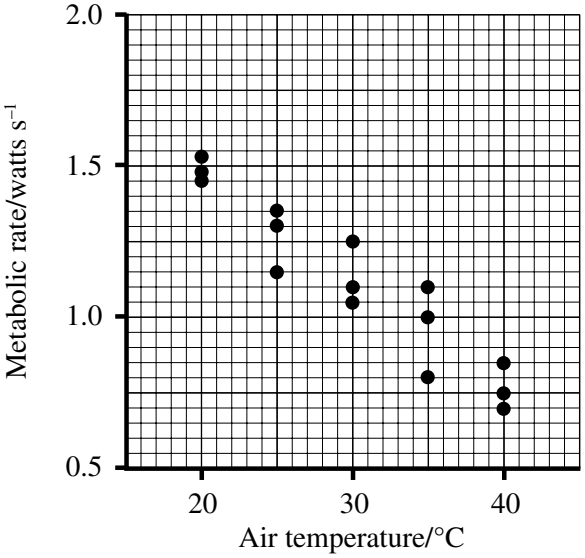
_____ [1]

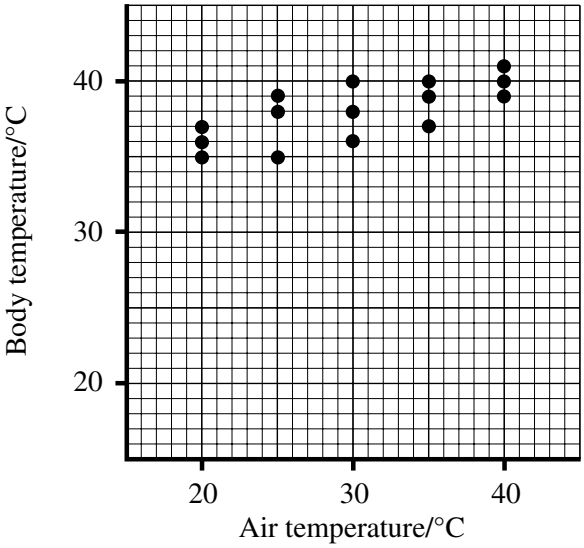
(c) Honeybees are able to fly even when the air temperature is relatively low. To investigate this, honeybees were exposed to air temperatures between 20 ° and 40 °C, and the following were measured:

- wing-beat frequency
- metabolic rate
- body temperature

The results of this study are shown in the graphs below.







Describe and explain the trends evident in the graphs.

Examiner Only	
Marks	Remark

_____

_____

_____

_____

_____

_____

_____

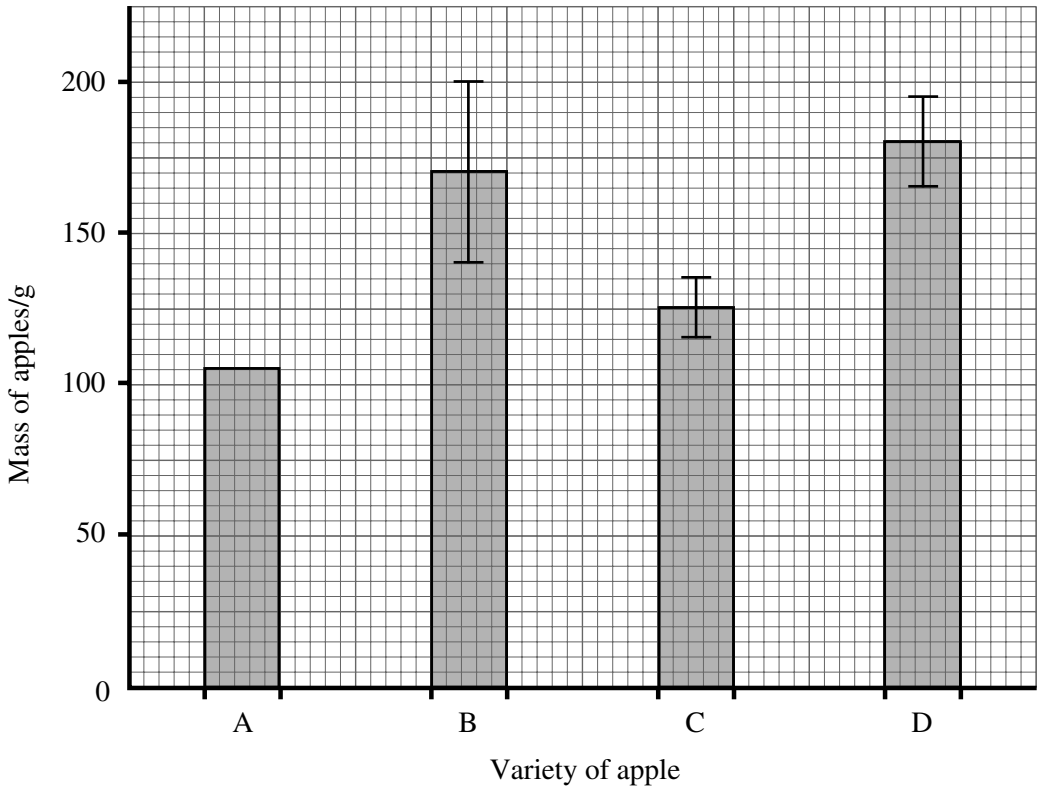
_____

_____ [5]

Examiner Only	
Marks	Remark

2 An orchard contained four varieties of apple tree. To compare fruit production for the four varieties, 30 apples of each variety were randomly chosen and weighed.

From the data for each variety, the means and standard deviation of the means were calculated and, for three of the varieties, the 95% confidence limits were determined. The means and 95% confidence limits are shown in the graph below.



(a) For the **variety A** sample (of 30 apples), the mean was 105, while the standard deviation of the mean ($\hat{\sigma}_{\bar{x}}$) was 12.2. (Units are grams.)

Calculate the 95% confidence limits, and **plot** these on the graph. (Use the space below for your calculation.)

Upper limit _____

Lower limit _____

[3]

(b) Identify which of the means of the four apple varieties is the most reliable. Explain your reasoning.

_____

_____

_____

_____ [2]

(c) Compare the means and confidence limits for **varieties B and C**. Do these suggest that there is a significance difference? Explain your reasoning.

_____

_____

_____ [2]

(d) The variable investigated was mass of apples. Suggest **one** other variable which might influence apple quality.

_____[1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(e) Apple variety D is diploid though it has a triploid strain. It was expected that fruit mass for the triploid strain would be 50% greater than that of the diploid strain. To test this hypothesis the total mass of 600 apples of each strain was compared using a χ^2 test.

(i) Complete the table below to calculate the χ^2 value for the test. (Units are kg.)

Strain	**Observed mass (O)**	**Expected mass (E)**	**(O – E)**	$\frac{(O - E)^2}{E}$
Diploid	109	100	9	
Triploid	141	150	–9	

χ^2 value _____ [2]

(ii) What does the calculated χ^2 value suggest about the expected greater mass of triploid apples compared with diploid apples? Justify your decision with reference to the probability value for the calculated χ^2 value.

_____

_____

_____

_____ [2]

(iii) Explain why it might be expected that the triploid apples would be 50% greater in mass than the diploid apples.

_____

_____ [1]

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(Questions continue overleaf)

3 Read the passage below and then use the information in the passage, and your own understanding, to answer the questions which follow.

Fungi belong to their own kingdom since they differ from all other organisms. They exist either as single cells or as chains of cells organised to form hyphae. Hyphae are organised into a branching network of filaments to form a mycelium – the living body of a fungus. Fungi reproduce asexually by the production of spores. The spore producing bodies are often elaborate structures.

Most species of fungi obtain their nutrients by breaking down dead organic matter, though some grow as parasites on other organisms. Fungi have eukaryotic cells, though none of their cells ever possess flagella, and have a rigid cell wall.

Phytophthora infestans is the fungus which infects potato plants. The fungal spores germinate on the surface of the leaf and developing hyphae invade the leaf through stomata. Once inside, the hyphae form a mycelium which proliferates through the entire plant and absorbs nutrients from within the cells. The bracket fungus, *Ganoderma applanatum*, invades the damaged bark of trees and its spore producing bodies appear as thick shelves on the trunk. Its destruction of tissue may lead to the death of the tree which it can feed off for years ahead.

Nevertheless most fungi may be seen as beneficial. Their most important role is as major decomposers in ecosystems. Their actions, along with those of many other microorganisms, release carbon and nitrogen back into the environment, thus playing an essential role in both the carbon and nitrogen cycles. Some are directly used by man. The yeast, *Saccharomyces cerevisiae* – strains of which are known as baker's or brewer's yeast – is used in both bread making and the fermentation process needed to produce beer and wine. Several species of fungi provide a major source of the antibiotics used to treat human bacterial infections. *Penicillium notatum* is the source of penicillin, while streptomycin is derived from *Streptomyces griseus*. Penicillin works by disrupting bacterial cell wall synthesis resulting in cell lysis. Streptomycin interferes with bacterial ribosomes and so inhibits protein synthesis.

Examiner Only	
Marks	Remark

(a) Fungi are distinctive from organisms in the other kingdoms [line 1].

(i) State **two** differences between fungi and plants.

1. _____

2. _____

[2]

(ii) State **two** differences between fungi and animals.

1. _____

2. _____

[2]

(b) Explain how "fungi obtain their nutrients by breaking down dead organic matter" [line 6].

_____

_____

_____

_____ [2]

(c) The potato blight fungus, *Phytophthora infestans* [line 9], was the cause of the potato famine in Ireland in the middle of the 19th century. The disease spread easily since there were only two strains of potato grown in Ireland at the time and so destruction of the crop was complete. Explain how the complete destruction of the potato crop might have been prevented if many strains had been grown.

_____

_____

_____

_____ [2]

(d) Antibiotics [line 23] are substances which have a negative effect on bacterial growth. Suggest why fungi, such as *Penicillium notatum* and *Streptomyces griseus*, produce these substances in their natural soil environment.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(e) Explain why streptomycin does not affect the metabolism of human cells while it is effective against bacteria [line 25 and 26].

_____

_____ [1]

(f) Explain why penicillin is rarely used nowadays to counter bacterial infections.

_____

_____ [1]

Examiner Only	
Marks	Remark

Section B

Examiner Only	
Marks	Remark

You are expected to answer the following question in continuous prose. Diagrams may be used, but you should make sure that they are relevant and add extra information to your account. It will be marked for its biological content, coverage of the topic, and the quality of written communication.

In this question up to two marks are awarded for the quality of written communication. [2]

4 Write an account of "how the structure of different cells is related to their function".

Your account should show understanding of, at least, **five** cell types that you have studied. [13]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER