GCE A Level – LEGACY

1075/01

HUMAN BIOLOGY – BY5

MONDAY, 11 JUNE 2018 – AFTERNOON

1 hour 45 minutes

ADDITIONAL MATERIALS
In addition to this examination paper, you may need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES
Use black ink or black ball-point pen.
Write your name, centre number and candidate number in the spaces at the top of this page.
Answer all questions.
Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets at the end of each question or part-question.
You are reminded of the necessity for good English and orderly presentation in your answers.
The quality of written communication will affect the awarding of marks.
1. (a) The diagram below shows gamete production as it occurs in the testes of male mammals.

(i) Name the process of gamete production in:

male mammals .................................................................

female mammals .............................................................

(ii) Name cell types A, B, C and D on the diagram.

A .................................................................

B .................................................................

C .................................................................

D .................................................................
(b) This process takes place in the seminiferous tubules. The drawing below shows a cross-section of one of these tubules.

(i) **Label the diagram** to show the position of cell types A, B, C and D. [2]

(ii) Name the cell labelled X on the diagram and describe its function. [2]
2. (a) The vegetation in mature forests can be classified into the following layers:

- Canopy
- Shrub layer
- Field layer
- Ground layer

(i) Name the final stage in the succession of a plant community. [1]

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(ii) Which of the layers shown in the diagram would be the last to form? [1]

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(iii) Describe how two abiotic factors would be affected when this layer is completely formed. [2]

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(b) The table below shows the results of a population study on the common shrew (*Sorex araneus*) in a young **pine tree** plantation on Anglesey.

<table>
<thead>
<tr>
<th>year</th>
<th>population / number of individuals per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>6</td>
</tr>
<tr>
<td>1961</td>
<td>7</td>
</tr>
<tr>
<td>1962</td>
<td>7</td>
</tr>
<tr>
<td>1963</td>
<td>6</td>
</tr>
<tr>
<td>1964</td>
<td>1</td>
</tr>
<tr>
<td>1965</td>
<td>no data</td>
</tr>
<tr>
<td>1966</td>
<td>3</td>
</tr>
<tr>
<td>1967</td>
<td>1</td>
</tr>
<tr>
<td>1968</td>
<td>1</td>
</tr>
<tr>
<td>1969</td>
<td>3</td>
</tr>
<tr>
<td>1970</td>
<td>2</td>
</tr>
</tbody>
</table>

(i) Plot the data as a graph on the grid below.
Shrews feed mainly on insects. The plantation was planted in 1954 and by 1963 the pine trees were fully grown. Suggest how the following would have been affected.

I. Ground vegetation: ................................................................. [1]

II. Herbivorous insects: ........................................................... [1]

III. Shrews: .................................................................................... [1]

Suggest another possible explanation for the large drop in the number of shrews between 1963 and 1964. [1]

The trees in deciduous forests lose their leaves each autumn. Suggest how the ground vegetation would have been affected and the impact this would have on the population of shrews. [2]
3. Warfarin is used as a rat poison. Resistance to this poison is thought to be controlled by a single dominant allele.

Prior to 1967, warfarin was used in all areas shown on the map below. The first incidence of warfarin resistance was recorded near Welshpool. The map also shows the spread of the allele for warfarin resistance between 1967 and 1970.

(a) (i) Explain how the warfarin resistance allele developed initially. [1]

(ii) Explain how the allele became common in the population around Welshpool. [3]

(iii) Suggest how the allele spread from Welshpool to the whole of the surrounding area. [2]
(b) Animals with the allele for warfarin resistance need large quantities of vitamin K in their diet. This vitamin is not always available and without it, resistant rats are unlikely to survive and breed.

The spread of the resistant population was dependent on the continued use of warfarin. When its use was discontinued the frequency of the resistant allele in the population decreased. Explain why this occurred.
4. Cauliflowers can be grown from seed or clones of plants can be produced by micropropagation.

(a) What do you understand by the phrase ‘clones of plants can be produced by micropropagation’? [3]

(b) Phloem sieve tube cells lack a nucleus. Explain why they cannot be used in micropropagation. [1]

(c) (i) Suggest two advantages of producing crops, such as cauliflowers, asexually. [2]

1. ........................................................................................................................................................................................

2. ........................................................................................................................................................................................

(ii) Suggest two disadvantages of producing crops asexually. [2]

1. ........................................................................................................................................................................................

2. ........................................................................................................................................................................................
(d) Plant geneticists have noticed that during micropropagation of cauliflowers the number of chromosomes in the cells of some plants was 36 and not 18 as in the parent plant.

(i) What type of mutation is illustrated by this example? [1]

(ii) Using your knowledge of mitosis, suggest how the number of chromosomes doubled in these plants. [3]

(e) Trials have been carried out to genetically modify cauliflowers to make their leaves much more green than normal. Genes for increased chlorophyll production were introduced into cauliflower cells by either attaching them to part of a cauliflower virus (which had been rendered harmless), or to a bacterial plasmid. Suggest three reasons why there are concerns about this technology. [3]
5. (a) The diagram shows a vertical section through a flower.

(i) Name the parts of the flower labelled A to E. [5]

A ..............................................................................................
B ..............................................................................................
C ..............................................................................................
D ..............................................................................................
E ..............................................................................................

(ii) Describe two features, shown in the diagram, which suggest that the flower is insect-pollinated rather than wind-pollinated. [2]

1. ..............................................................................................
2. ..............................................................................................
(b) The female reproductive system of this flower is shown in detail in the diagram below.

(i) Describe how the pollen tube passes through the tissues indicated by the dotted line on the diagram. [3]

(ii) Name X on the diagram. [1]

(iii) Following fertilisation, different structures will develop into parts of the seed and fruit. Use the letters below to label on the diagram above the structures that will develop into the following: [4]

- P fruit
- Q testa
- R endosperm
- S embryo plant
6. In guinea pigs, black coat colour is dominant to brown and short hair is dominant to long. These characters are not linked.

Long haired, brown, male guinea pigs were crossed with short haired, black, female guinea pigs. Four different phenotypes were observed in the offspring.

(a) Complete the genetic diagram showing the result of this cross. [5]

Use the following symbols to represent the alleles:

- Black coat: $B$
- Brown coat: $b$
- Short hair: $H$
- Long hair: $h$

Parental phenotypes: Long haired, brown | Short haired, black
Parental genotypes: .................................................... | ....................................................
Gametes: .................................................... | ....................................................

F1 genotypes: .................................................... | .................................................... | .................................................... | ....................................................
F1 phenotype: .................................................... | .................................................... | .................................................... | ....................................................
(b) Guinea pigs produce their gametes through meiosis. The diagram below shows how a pair of homologous chromosomes pair up during Prophase I of meiosis. The positions of the alleles of two genes, A and B, are shown.

Explain how different gametes can be produced even though these genes are carried on the same chromosome. [3]

(c) Guinea pigs and rabbits are popular pet animals and are often kept together in the same cage where they can have intercourse. There have been unconfirmed reports of guinea pigs and rabbits producing hybrid offspring.

Considering that guinea pigs have a diploid chromosome number, 2n = 64, and rabbits, 2n = 44, suggest why their offspring would be infertile. [2]
7. **Answer one** of the following questions.

Any diagrams included in your answer must be fully annotated.

**Either;**  
(a) Define the terms biodiversity, extinction and conservation. Explain how human activities can reduce biodiversity. Describe the steps that conservationists have taken to maintain species that are facing extinction.  

Or.  
(b) Explain why nitrogen is important to living organisms. Describe how nitrogen is recycled in nature and how this is affected by human activities.