GCSE Double Award Biology Higher Tier

Unit 4 / Biology 2: Topic 4.3

DNA and Inheritance

1.

The diagram shows the two chains of a DNA molecule which have been separated. The letters represent chemicals which code for units of protein. Three letters in a row code for a single unit of a protein.

Chain X	G	A	T	G	C	A	A	G	C	G	G	T	T	G	A	A	G	C	G	A	G	A
Chain Y	C	T	A	C	G	T	T	C	G	C	C	A	A	C	T	T	C	G	C	T	C	T

(a) What group of chemicals is represented by the letters A, T, C, G? [1]

.....

(b) Name the units of a protein molecule. [1]

.....

(c) What is the maximum number of units of protein that can be coded by chain X? [1]

.....

(d) Normally the two chains are twisted around each other. What is the name for this shape of the DNA molecule? [1]

.....

(e) Name a group of proteins which have an important function in the body. [1]

2.

Leeches help in hunt for rare species

Leeches feed on the blood of mammals. Leeches can keep blood cells in their digestive systems for four months.
It was suspected that several endangered species of mammals existed on an island. These mammals had not been seen on the island for 25 years, but their genetic profiles had been stored in laboratories.

Explain how scientists could use leeches, collected on the island, and the technique of genetic profiling to prove that the endangered species of mammals still exist. [3]

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3.

Mrs Hughes is a well known breeder of both yellow and black Labrador dogs. The allele for black coat (**B**) is dominant to the allele for yellow coat (**b**). Mrs Hughes finds it easier to sell black Labrador puppies because they are more popular. She does however produce yellow Labrador puppies when there is a demand for them.

Mrs Hughes has recently bought a black Labrador dog because it has many of the features which judges look for in dog shows, but she does not know its genotype.

(a) State the meaning of the term *genotype*. [1]

.....

.....

(b) (i) Mrs Hughes wants to breed from the black Labrador she has just bought but needs to know its genotype. How could she find out its genotype? Give a full explanation of the cross she could carry out and the expected results. [3]

.....

.....

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.....

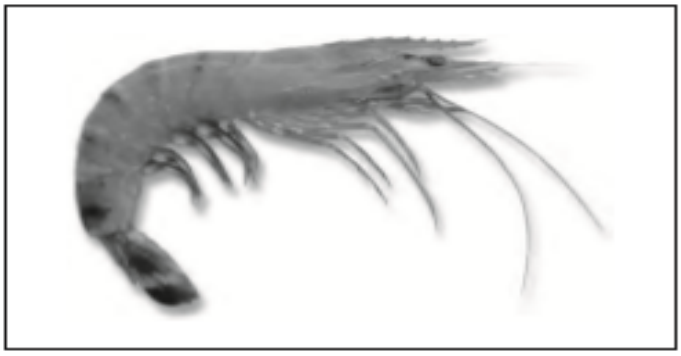
.....

(ii) Complete the Punnett squares below to show the **possible** results of this cross. [2]

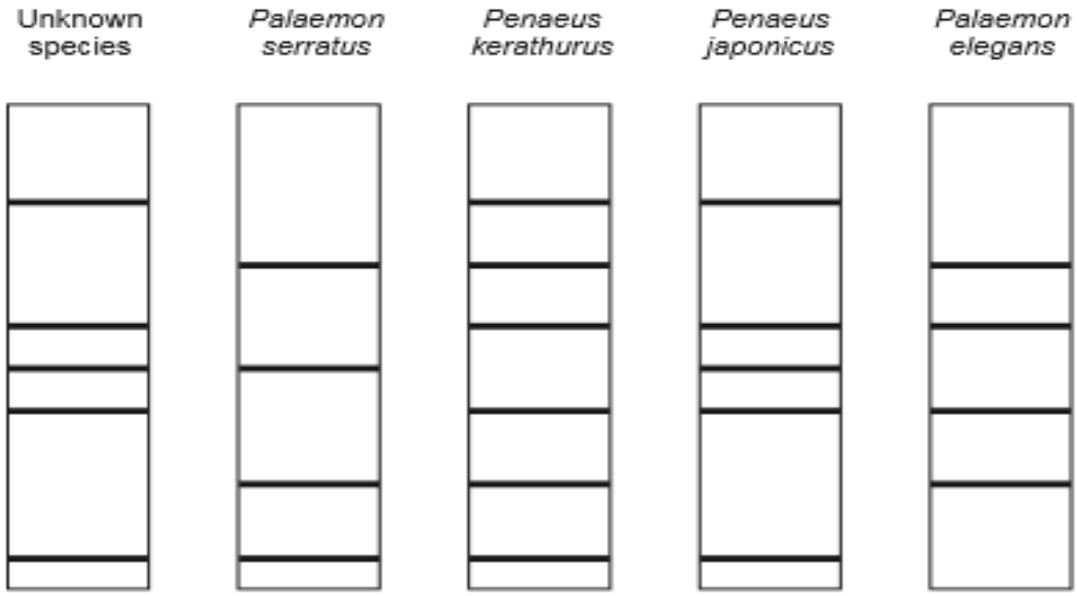
Gametes		

Gametes		

4.



In 1989, fishermen in the English Channel caught specimens of a species of prawn which they could not identify. They sent the prawns to a marine biologist who said that the species had not been recorded in British waters before. He identified the species by comparing its genetic profile with those of known species of prawn. The results are shown below.



(a) Use the genetic profiles to identify the unknown species. [1]

.....

(b) Which of the other prawn species would be most likely to cross breed with the unknown species? Give a reason for your answer. [2]

.....

.....

(c) Prawns have different names in different languages. For example: Italian – gamberi and French – crevette. State precisely, how marine biologists avoid confusing the names of the organisms that they study. [1]

.....

5.

In cats, the allele for short hair **(D)** is dominant to the allele for long hair **(d)**.

A cat with short hair was mated with a cat with long hair. All the offspring **(F1)** had short hair.

(a) (i) Complete the following to show the genotypes of the parents. [1]

I. The cat with short hair. .....

II. The cat with long hair. .....

(ii) Complete the Punnett square to show the cross between the cat with short hair and the cat with long hair. [2]

	Gametes		
F1			

(b) (i) Complete the Punnett square to show the offspring produced on selfing (breeding together) two of the **F1** generation. [2]

	Gametes		
F2			

(ii) Complete the following to show the ratio of the different types of offspring appearing in the **F2** generation. [1]

..... homozygous dominant: ..... heterozygous: ..... recessive

6.

A Soya crop

The flow chart below shows the principles of a process used to improve crop plants by genetic modification **IN THE CORRECT ORDER**.

Flow chart	
Principles of genetic modification of a crop plant	
A	A useful gene is identified.
	↓
B	The useful gene is transferred to cells of a crop plant.
	↓
C	The crop plant's cells produce many genetically modified plants.
	↓
D	The new genetically modified crop plants undergo trials to find out if the useful gene has the desired effect.

The table below lists the stages used in the genetic modification of soya. The stages are listed in the **WRONG ORDER**.

Stages in the genetic modification of soya	Letter
Soya plants of the new variety are tested in the field to find out if they resist herbicides.	.....
Whole soya plants are grown from genetically modified cells of soya plants.	.....
Agrobacterium tumefasciens infects soya plant cells passing on the gene which controls herbicide resistance.	.....
Agrobacterium tumefasciens has a gene which controls herbicide resistance.	.....

(a) Use the letters **A**, **B**, **C** and **D** shown in the flow chart opposite to complete the table above, matching the **principles** with the **stages** in the genetic modification. **[3]**

(b) State **one** reason why farm scale field trials are needed before a genetically modified crop is grown. **[1]**

.....

.....

7.

Outline the basic structure of DNA and explain the meaning and importance of the genetic code in the production of proteins. An account of protein synthesis is not required.

DO NOT USE DIAGRAMS. [6 QWC]

END OF TEST