



(ii) List the processes which contribute to **B** in the meadow where sheep are raised.

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.....  
..... [2]

(iii) Name the bacteria that carry out processes **C** and **D**, **and** explain the significance of these bacteria for the growth of plants.

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.....  
.....  
..... [3]

(iv) Use the letters on Fig. 1.1 to explain why the soil nitrate concentration will decrease in the cabbage field if it is used to grow repeated crops of cabbages year after year.

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.....  
..... [3]



- (b) The sheep on this farm belong to a rare breed called Greyface Dartmoor. The Rare Breeds Survival Trust (RBST) gives advice on looking after these sheep and keep records to monitor the breeding of these sheep, in order to maintain a healthy population.

Why is the continued existence of rare breeds of farm animals desirable?

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.....  
.....  
.....  
.....  
..... [2]

- (c) North Ronaldsay sheep are listed as 'endangered' by the Rare Breeds Survival Trust. These sheep were raised on a small Scottish Island where they were kept along the seashore for most of the year. The sheep developed an unusual metabolism that allowed them to survive by eating seaweed. They are, however, susceptible to copper poisoning when fed on grass.

- (i) State the **two** essential steps that must have occurred for a breed to develop a distinctive metabolism, such as the ability to eat mainly seaweed.

.....  
..... [2]

- (ii) Suggest what particular problems make the North Ronaldsay breed one of the most endangered sheep breeds in the United Kingdom.

.....  
.....  
.....  
.....  
..... [2]

[Total: 20]

Turn over

2 Animals behave in ways that enhance their survival and reproductive capacity. This behaviour may be innate or learned.

(a) Describe what is meant by:

(i) innate behaviour

.....  
.....  
.....  
.....  
.....  
..... [2]

(ii) learned behaviour.

.....  
.....  
.....  
.....  
.....  
..... [2]

(b) Describe the advantages to animals of innate **and** learned behaviour, with reference to specific examples of each type of behaviour.



*Your answer should include both types of behaviour and make clear the advantages to the animals of your chosen examples.*

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(c) Elm trees respond to fungal infection by plugging their xylem vessels. The leaves on the upper branches of the tree then turn yellow and die. When most of the branches have lost their leaves and died, the roots are weakened and may also die.

(i) Explain why the plugging of xylem vessels will result in the leaves of the upper branches turning yellow.

.....  
.....  
.....  
.....  
.....  
..... [2]

(ii) Explain why the loss of leaves from the tree may result in the death of the tree's roots.

.....  
.....  
.....  
.....  
.....  
..... [2]

**QUESTION 3(d) STARTS ON PAGE 10**

**Turn over**





(e) List **two** advantages and **two** disadvantages of cloning plants by tissue culture.

advantage 1 .....

.....

advantage 2 .....

.....

disadvantage 1 .....

.....

disadvantage 2 .....

..... [4]

[Total: 22]

Turn over

4 Wading birds (waders) are birds that feed in shallow water. Table 4.1 shows changes in the population size of four species of wader in two areas of the Western Isles off the coast of Scotland.

- Area 1 is an area that has remained free of hedgehogs.
- Area 2 is an area where four hedgehogs were introduced from the mainland in 1974. Since then, they have established a large population.

Hedgehogs eat the eggs of ground-nesting birds like waders.

**Table 4.1**

		number of breeding pairs of wader birds			
		area 1 (hedgehogs absent)		area 2 (hedgehogs present)	
species of wader	year	1983	2000	1983	2000
	lapwing		1104	1364	1869
redshank		486	733	1288	760
dunlin		803	558	2016	884
snipe		172	154	655	280

(a) (i) Calculate the percentage decrease in the number of breeding pairs of **snipe** in **area 2** between 1983 and 2000.

Show your working.

Answer = ..... % [2]





5 Fig. 5.1 is a circular representation of the genetic code.

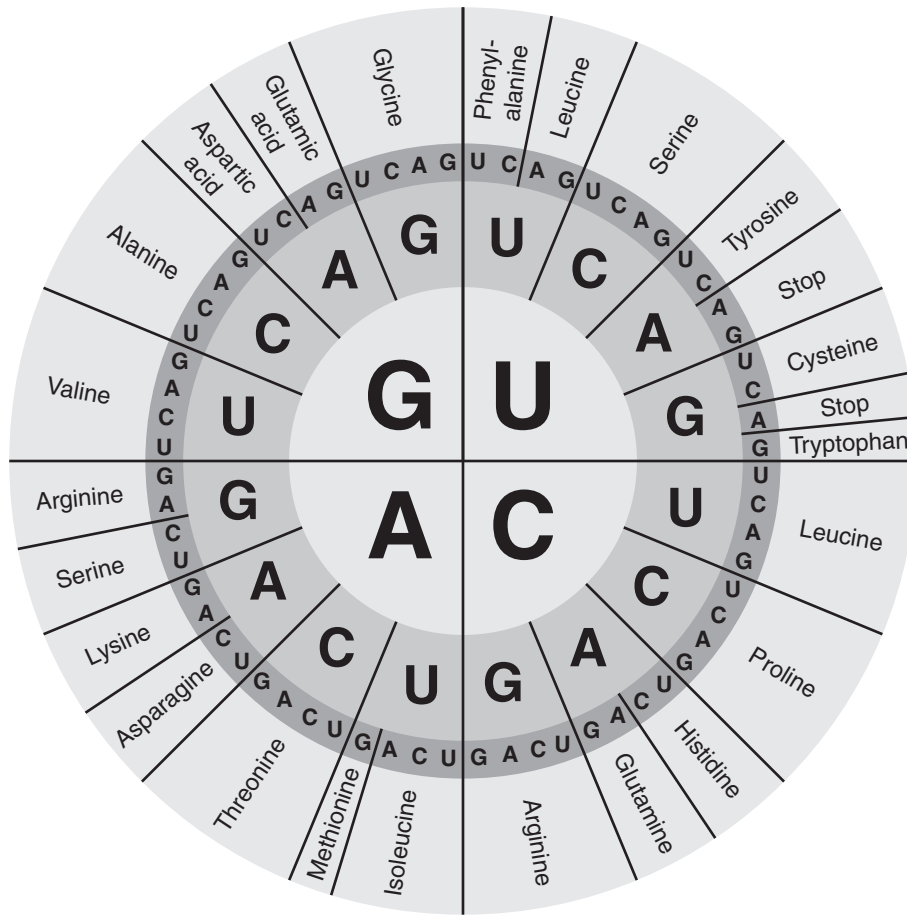


Fig. 5.1

(a) Fig. 5.2 shows a sequence of bases coding for a sequence of amino acids. The name of the third amino acid in the sequence has been filled in.

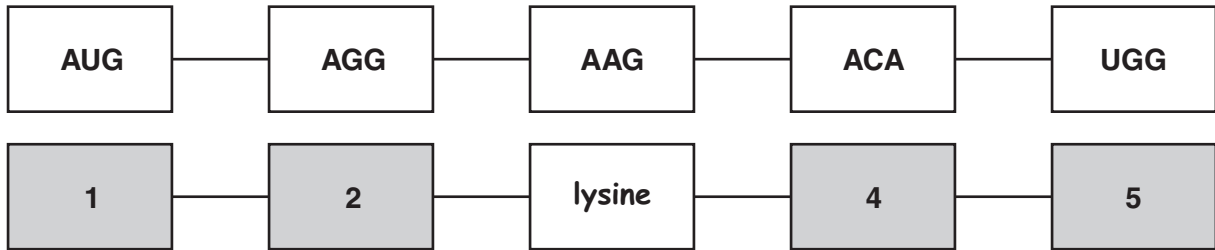


Fig. 5.2

Identify the remaining amino acids in the sequence.

- 1 .....
- 2 .....
- 3 **lysine**
- 4 .....
- 5 ..... [2]

(b) State the name of the stage of protein synthesis represented in Fig.5.2 **and** name the organelle in the cell where this takes place.

.....  
 ..... [2]

(c) Identify the type of nucleic acid that holds the sequence of bases shown in Fig. 5.2.

..... [2]

(d) Using the information in Fig. 5.1, list the **three** triplet codons that would cause termination of a polypeptide chain (stop codons) **and** explain why these codons have this effect.

.....  
 .....  
 .....  
 .....  
 ..... [2]

(e) What name would be given to a mutation that resulted in a change of the codon **UUU** to **UUC**?

..... [1]

[Total: 9]

Turn over

6 Describe the differences between:

(a) somatic cell gene therapy and germ line cell gene therapy

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.....  
.....  
.....  
.....  
..... [2]

(b) the central nervous system and the peripheral nervous system

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

(c) prophase 1 of meiosis and prophase 2 of meiosis.

.....  
.....  
.....  
.....  
..... [2]

[Total: 8]



- 7 Two-spot ladybirds, *Adalia bipunctata*, show a colour polymorphism. They are normally red with two black spots. However, melanic individuals occur which are black with two red spots.

A student investigated the proportion of these colour forms in the ladybird population along a transect going up a hill near his school.

- (a) (i) Suggest a suitable technique by which the student might have collected his samples of ladybirds along this transect.

.....  
.....  
..... [1]

- (ii) The student's teacher suggested he should make several transects up the hill rather than just one transect.

Explain why this is good experimental design.

.....  
.....  
..... [1]

**QUESTION 7(b) STARTS ON PAGE 20**

**Turn over**



(c) The black, melanic, form of the ladybird is caused by an allele (**B**) that is dominant.

The red form of the ladybird is therefore homozygous recessive at this locus (**bb**).

(i) State what is meant by the term *recessive*.

.....  
 .....  
 ..... [1]

(ii) The data in Table 7.1 give the total number of the red form of ladybird found as 296, and the total number of the black form of ladybird as 50.

The Hardy-Weinberg principle states that:

$$p + q = 1$$

$$p^2 + 2pq + q^2 = 1$$

Use the Hardy-Weinberg principle and the figures given above to calculate the frequency of the dominant allele, *p*, and the recessive allele, *q*, in the two-spot ladybird population.

Show each step in your working. **Give your answers to 2 decimal places.**

*p* = .....

*q* = ..... [3]

[Total: 11]

**END OF QUESTION PAPER**