WJEC CBAC

GCE A level

1075/01

BIOLOGY/HUMAN BIOLOGY - BY5

A.M. FRIDAY, 22 June 2012

1¾ hours plus your additional time allowance

Surname _____

Other Names _____

Centre Number _____

Candidate Number 2 _____

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	5	
2.	8	
3.	7	
4.	6	
5.	17	
6.	11	
7.	8	
8.	8	
9.	10	
Total	80	

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen or your usual method.

Write your name, centre number and candidate number in the spaces on the front cover.

Answer ALL questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.

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.

A	secondary productivity
B	biomass
C	eutrophication
D	trophic efficiency
E	pyramid of energy
F	coppicing
G	monoculture
H	algal bloom
I	carbon footprint

1. **The following list of terms concerns ecology and related topics. [5]**

Below are five statements. Select from the list opposite the LETTER for an appropriate term to match each statement.

(a) **The rate at which consumers accumulate energy in the form of cells or tissue.** ☐

(b) **The total level of carbon dioxide due to the actions of an individual, mainly through their energy use, over a period of one year.** ☐

(c) **A natural process which results from the build up of nitrates in lakes and rivers.** ☐

(d) **A technique whereby trees are cut down close to the ground and then left for several years to re-grow shoots.** ☐

(e) **The simultaneous growth of a large number of crop plants of similar age and type within a defined area.** ☐

(Total 5 marks)

2. (a) Most flowering plants are adapted for pollination by wind or insects.
Define the term pollination. [1]

_____

_____

_____

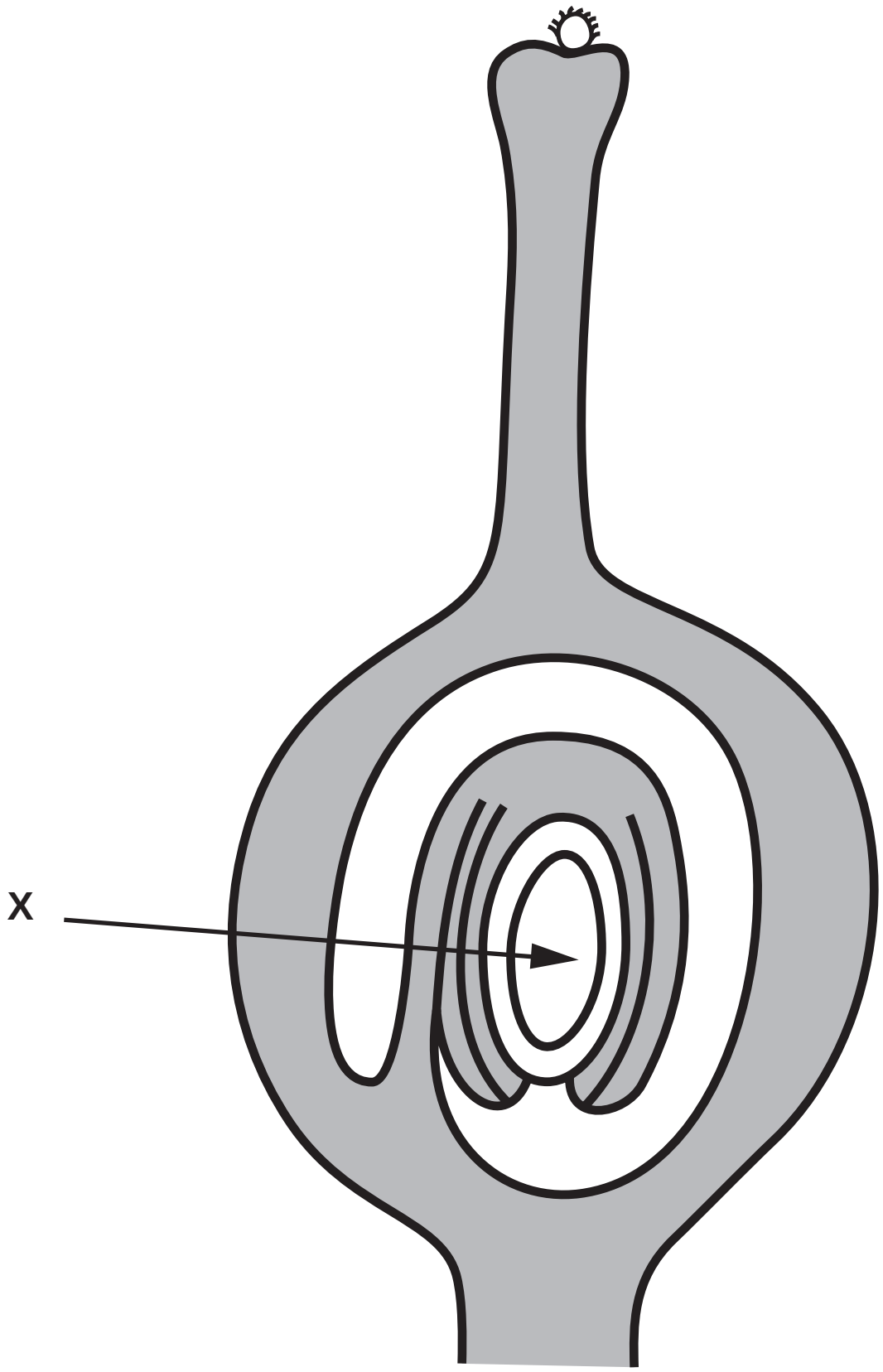
(b) After pollination a pollen tube grows through the carpel of a flower.
The diagram opposite shows a longitudinal section through a carpel with a pollen grain on the stigma.

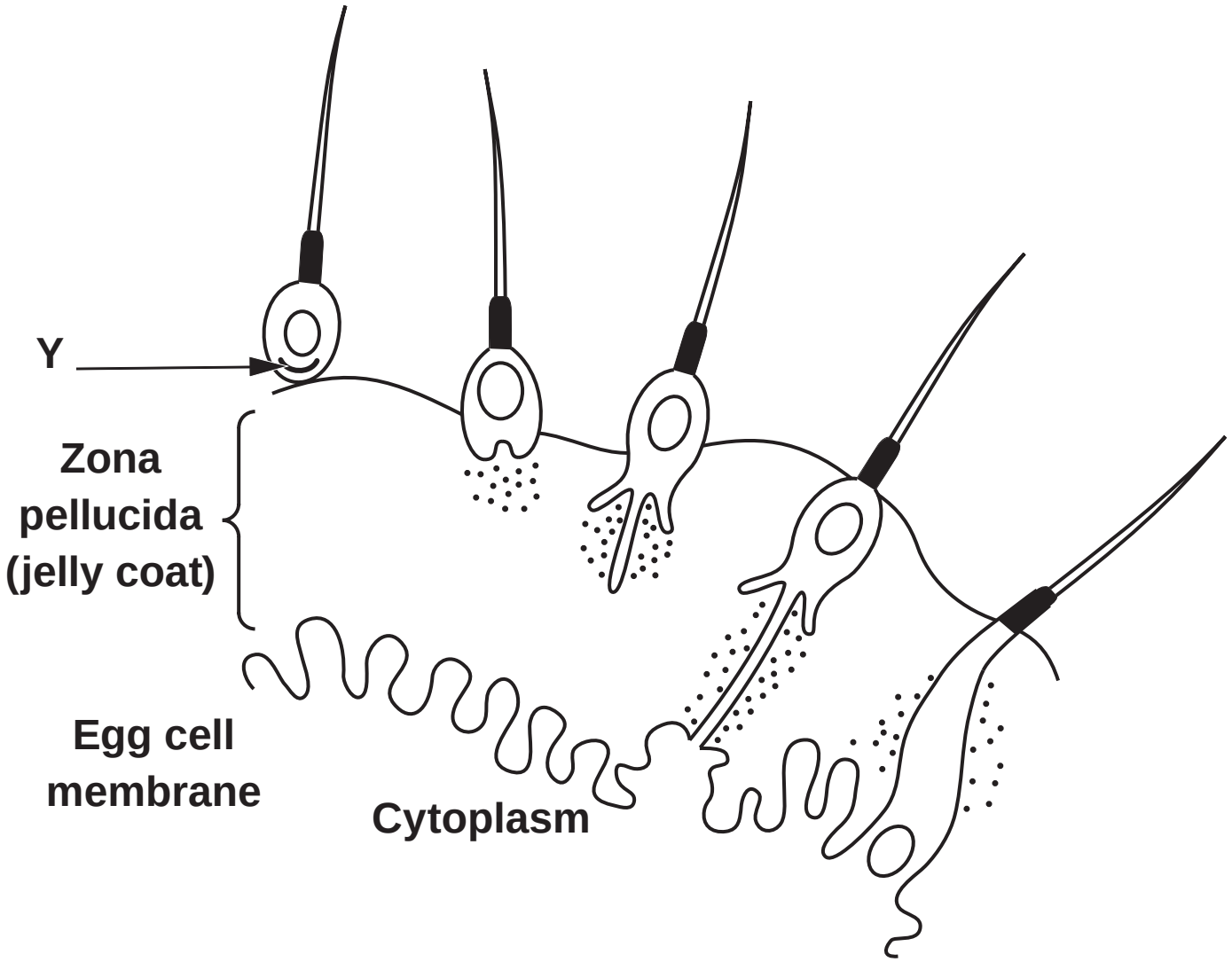
(i) Name the structure X shown in the diagram. [1]

_____

_____

(ii) Draw a line ON THE DIAGRAM to indicate the route of growth of a pollen tube through the carpel to structure X. [1]


X


Y
Zona pellucida (jelly coat)
Egg cell membrane
Cytoplasm

2(c) **The diagram opposite shows the sequence of events which take place when the nucleus of an animal sperm enters the cytoplasm of the egg.**

(i) **Name the part of the reproductive tract in which these events take place. [1]**

_____

_____

(ii) **Use the information in the diagram to explain the role of Y in the process. [2]**

_____

_____

_____

_____

_____

(d) **State TWO similarities between the process visible in the diagram in part (c) and the process by which the male nucleus enters a plant ovule.**

[2]

1. _____

_____

2. _____

_____

(Total 8 marks)

3. A maize plant homozygous for smooth, coloured grain was cross-pollinated with a plant homozygous for wrinkled, colourless grain. The F1 plants all produced smooth, coloured grain. On cross-pollinating the F1 plants, it was found that most of the F2 generation resembled the original plants, 73% producing smooth, coloured grain and 22% producing wrinkled, colourless grain.

(a) Which of the characteristics described above are

(i) dominant _____

_____

(ii) recessive _____

_____

[2]

(b) What conclusion can be drawn about these genes? [1]

_____

_____

3(c) (i) State the probable phenotypes of the remaining 5% F2 plants NOT described on page 8. [1]

_____

(ii) Suggest how these phenotypes arose. [1]

_____

(d) Using appropriate symbols to represent the alleles, give the genotype of an

(i) F1 plant _____

(ii) F2 plant you described in (c) _____

[2]

(Total 7 marks)

USE THE SPACE BELOW FOR YOUR ROUGH WORKING. IT WILL NOT BE MARKED.

4. **The evolution of a new species over a long period of time begins when some sort of ISOLATING MECHANISM (1) separates a population into two or more subgroups. Natural selection acting on the subgroups ensures that the individual most suited to the conditions survive or breed more successfully, that is, SURVIVAL OF THE FITTEST (2). If the conditions facing the two subgroups are different they will gradually show DIVERGENCE (3) from the ancestral form and from each other. Evidence for the evolutionary relationship of organisms can be derived directly from their FOSSIL RECORD (4) and from their CLASSIFICATION (5).**

The following statements could be used to illustrate ONE OR MORE of the numbered terms. After each statement, write in the appropriate NUMBER or NUMBERS.

(a) **The pentadactyl limb is a characteristic of extinct and present day mammals. [1]**

_____

4(b) A wide range of bacteria are now resistant to penicillin. [1]

(c) Over 500 species of plants have been recorded on the Galapagos islands and 180 of these are not found anywhere else in the world. [1]

(d) Two species of pine trees are found in Monterey Bay, California. PINUS RADIATA produces pollen in February and P. ATTENUATA produces pollen in April. [1]

(e) A particular plant-feeding bug, arrives on a suitable host and lives there for several weeks and produces a large number of offspring. [1]

(f) The cichlid fish are a family recognised by their curious jaw formation.
In Lake Victoria there are about 450 different species. [1]

(Total 6 marks)

5. (a) (i) What is meant by the term ‘gene therapy’? [1]

_____

_____

_____

5(a) (ii) **The following statements describe the two different types of gene therapy, somatic cell therapy and germ line therapy.**

1. **Targets cells in affected tissues**
2. **Introduces genes into the egg**
3. **Inherited**
4. **Not inherited.**

Under the two headings below write the appropriate NUMBERS of the statements that describe the two forms of gene therapy. [2]

Somatic cell therapy	Germ line therapy

5(b) (i) **Cystic fibrosis is caused by a mutation of the gene producing the protein CFTR. Explain how the presence of this altered protein results in the production of thick, sticky mucus and how this accounts for the respiratory symptoms of the disease. [4]**

5(b)(ii) **Describe ONE technique that could be used to introduce functional CFTR genes into someone with cystic fibrosis. [3]**

5(c) (i) Explain why the replication of DNA is described as semi-conservative. [1]

(ii) The polymerase chain reaction (PCR) is used to make many copies of a section of DNA. Each stage of the reaction takes place at different temperatures. [3]
Explain why during each stage

I. the DNA is first heated to 95°C

5(c)(ii) II. the temperature is then reduced to 55°C

III. the temperature is then increased to 70°C

5(c)(iii) **About twenty percent of the DNA produced by the polymerase chain reaction (PCR) is copied inaccurately. Suggest and explain why it is not safe to use the PCR to clone the CFTR gene for use in treating cystic fibrosis.** **[3]**

(Total 17 marks)

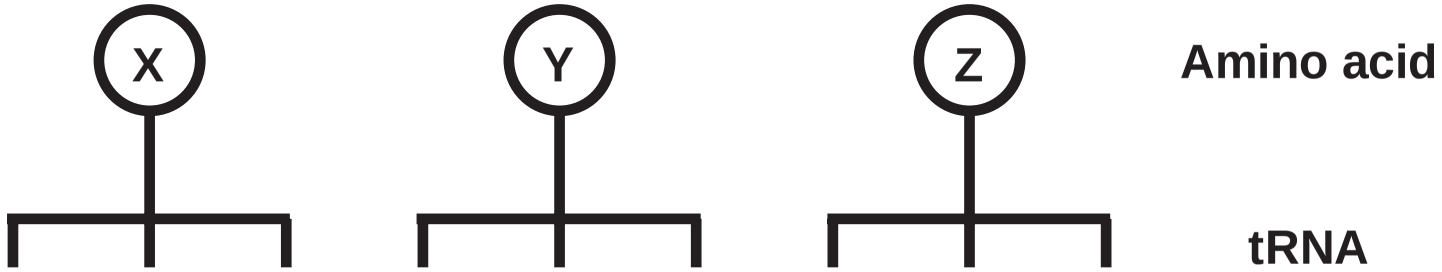
6. (a) Name the enzyme involved in the transcription stage of protein synthesis. [1]

(b) The diagram opposite shows some molecules involved in protein synthesis.

Complete the diagram to show

(i) the bases on the template DNA strand from which the mRNA was transcribed; [1]

(ii) the bases forming the anticodons of the tRNA molecules. [1]



Translation

Transcription

6(c) **The diagram opposite shows the effects of two different mutations of the DNA on the base sequence of the mRNA.**
The table shows the mRNA codons for three amino acids.

Use the information in the table to

(i) **Identify amino acid X in the diagram in part(b) (opposite page 19). [1]**

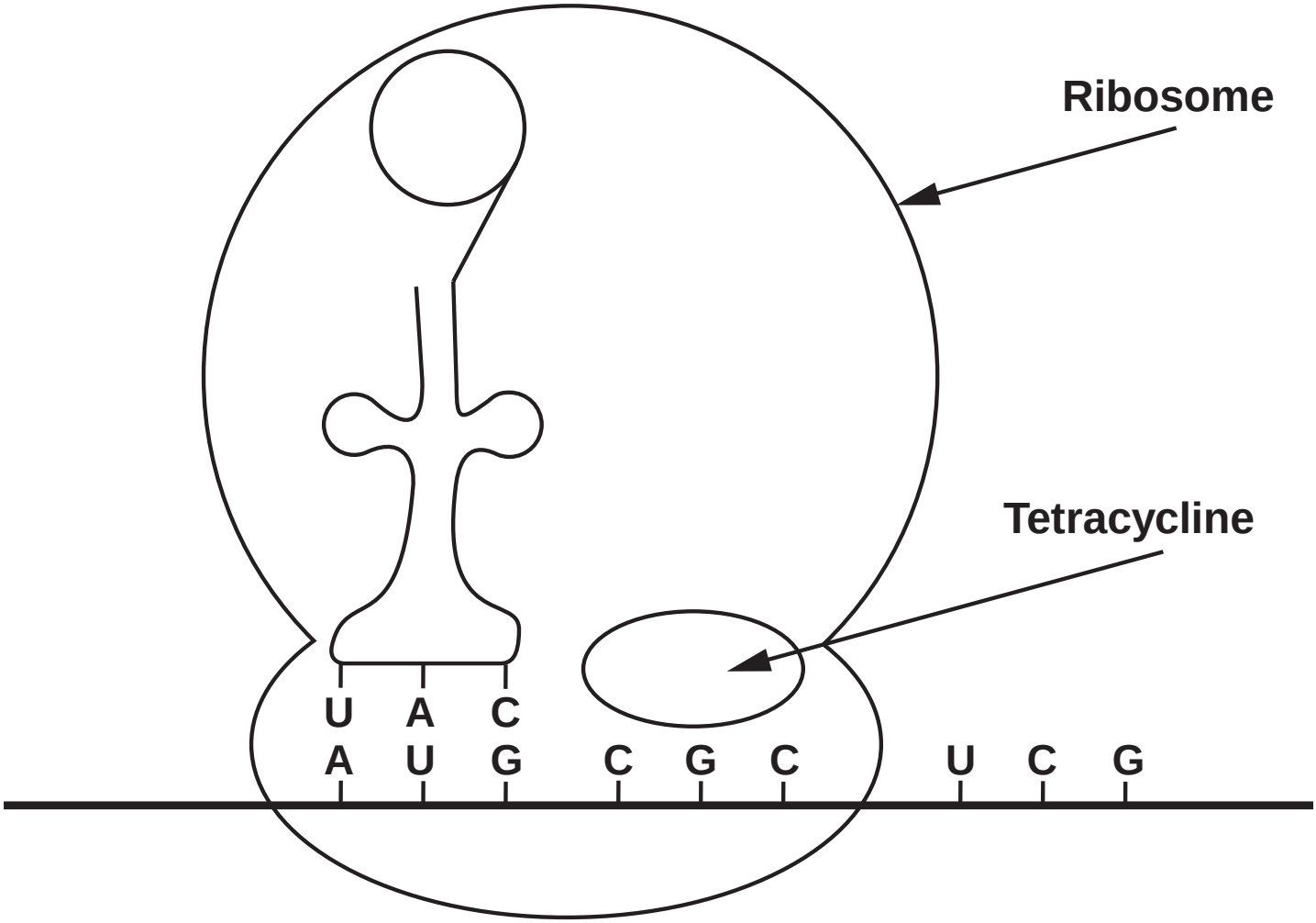
_____

_____

6(c) (ii) **Explain how each mutation, shown in the diagram opposite page 20, may affect the polypeptide for which this section of DNA is part of the code.**

Mutation 1 [2]

Mutation 2 [2]


Ribosome
Tetracycline
U A C
A U G C G C U C G

6(d) **Tetracycline is an antibiotic. The diagram opposite shows how tetracycline binds to bacterial ribosomes.**

Explain how the tetracycline stops protein synthesis in bacteria. [3]

(Total 11 marks)

7. (a) **In the formation of recombinant DNA many different restriction endonuclease enzymes are used. Each enzyme cuts the DNA of a plasmid at a specific base sequence called a restriction site.**
The diagram opposite shows the position of restriction sites, A, B, C and D, for each of four different enzymes on a plasmid.
The distance between these sites is measured in kilobases of DNA.

(i) **Which of the restriction sites were cut? [1]**

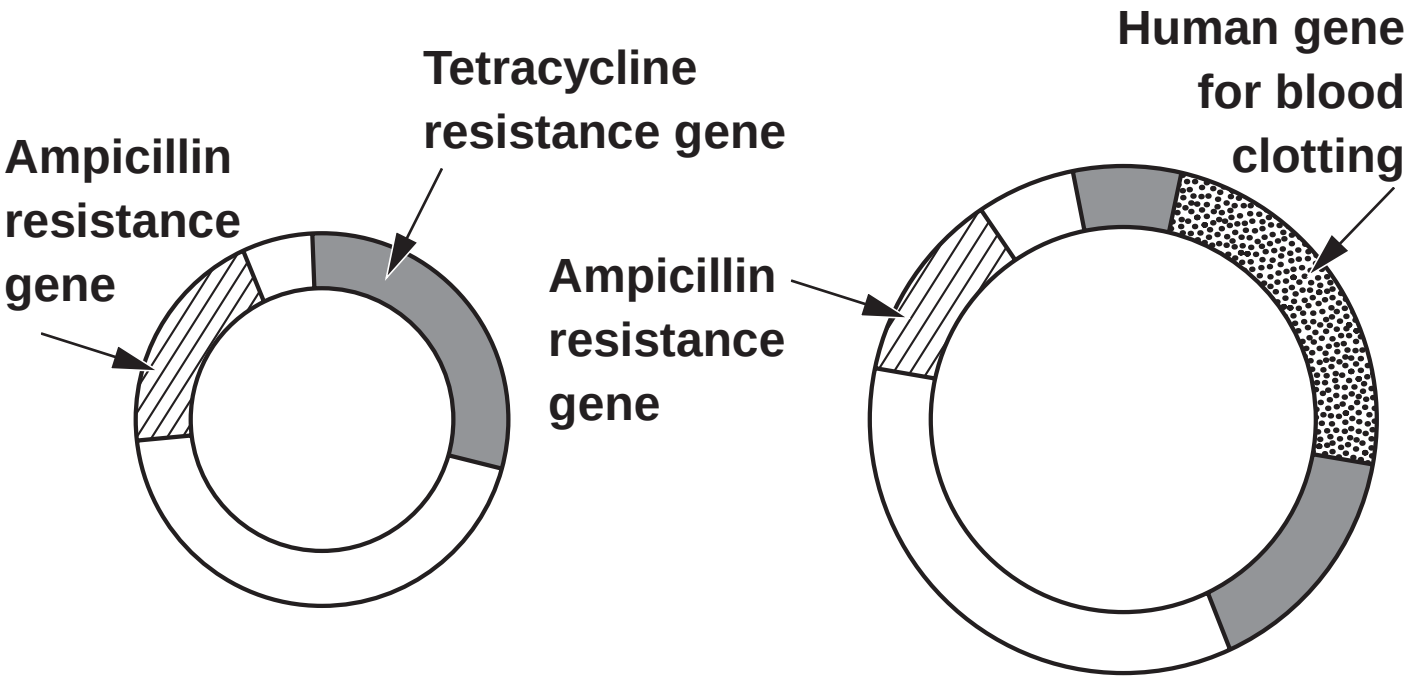
_____

(ii) **Explain your answer. [1]**

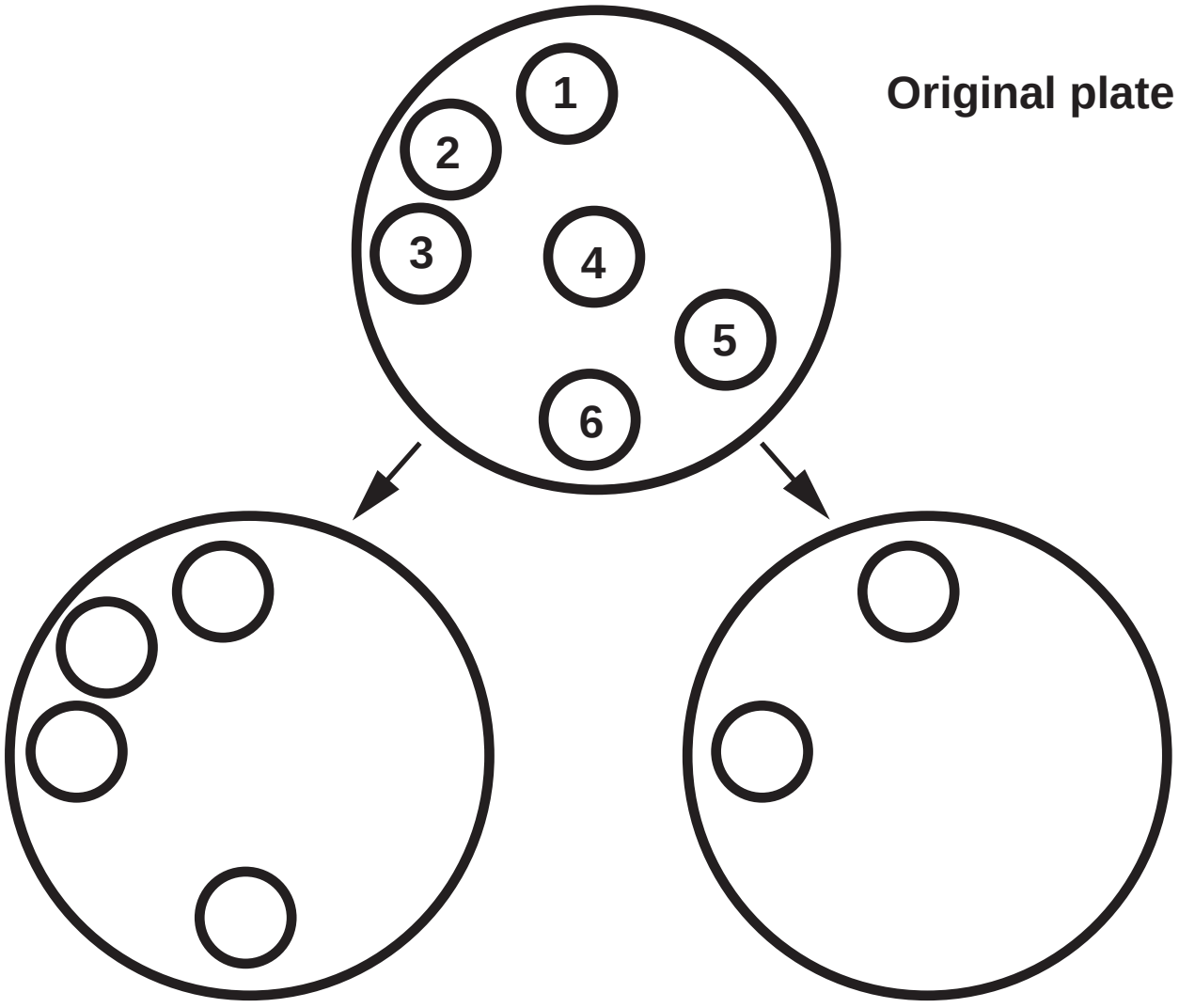
_____

_____

7(b) **In genetic engineering, genes for antibiotic resistance in bacterial plasmids can be used as genetic markers. Scientists used a plasmid containing genes for resistance to two antibiotics, ampicillin and tetracycline. A human gene for blood clotting was inserted in the plasmid in the position shown in diagram below.**



Plasmids were then inserted into bacteria, although some of the plasmids had not taken up the human gene. Plates were replicated to identify the bacteria with the human gene. The diagram overleaf shows the bacterial colonies that grew on the two replica plates.



7(b)(i) **COMPLETE THE ABOVE DIAGRAM by writing the correct NUMBERS for the bacterial colonies that grew on the replica plates. [1]**

7(b)(ii) **Explain the results of the replica plate containing ampicillin. [2]**

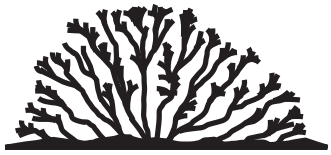
(iii) **Explain the results of the replica plate containing tetracycline. [3]**

(Total 8 marks)

8. (a) Explain what is meant by the following terms:

(i) Succession [2]

(ii) A climax community. [1]

Time after burning/ years	Appearance of heather plant	Mean percentage cover of heather	Other plant species present
4		10	Many
12		90	Few
19		75	Several
24		30	Many

8(b) **Heather plants are small shrubs and are the dominant species in the climax community of some moorlands. The structure and shape of the heather plant changes as it ages. This results in changes in the species composition of the community. A large area of moorland was burnt leaving bare ground. The table opposite shows four stages of succession in this area.**

Explain why the number of other plant species decreases between 4 and 12 years after burning.

[2]

8(c) **The rate at which a heather plant produced new biomass was measured in g per kg of heather per year. As the plant aged the ratio of leaves to woody parts decreased. Use the information in the table to explain why. [3]**

(Total 8 marks)

9. Answer ONE of the following questions. Any diagrams included in your answer must be fully annotated.

EITHER, (a) Define the terms conservation and extinction. Discuss the importance of the conservation of genetic sources. Describe steps conservationists have taken to prevent the extinction of endangered species. [10]

OR, (b) (i) Give an account of the principles involved in cloning of mammals, including the use of stem cells. [8]

(ii) Discuss the possible objections to the use of stem cells. [2]

(Total 10 marks)

Original mRNA

Mutation 1

Mutation 2

AMINO ACID	MRNA CODON
methionine	AUG
valine	GUC GUU
alanine	GCA GCC GCU

The plasmid was cut using only TWO of the restriction enzymes. The resulting fragments were separated by gel electrophoresis. The positions of the fragments are shown in the chart.