

3.4 Genetic Modification & Biotechnology

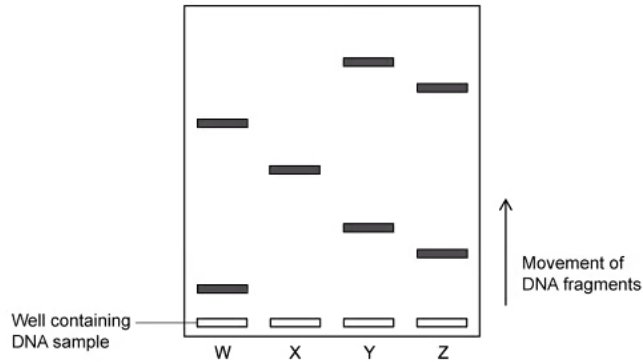
Question Paper

Course	DP IB Biology
Section	3. Genetics
Topic	3.4 Genetic Modification & Biotechnology
Difficulty	Easy

Time allowed: 50
Score: /40
Percentage: /100

Question 1a

a)
In the electrophoretogram, the DNA has moved from the negative cathode to the positive anode.



State the property of DNA which results in movement from cathode to anode.

[1 mark]

[1 mark]

Question 1b

b)
State **two** uses of gel electrophoresis.

[2 marks]

[2 marks]

Question 1c

c)
In some situations, gel electrophoresis cannot be carried out as the DNA samples are not collected in a large enough quantity.

Identify the process used to amplify the DNA in order to supply enough DNA for electrophoresis to be successful.

[1 mark]

[1 mark]

Question 1d

d)
The stages of electrophoresis can be seen below.

Complete the table below by adding a number to the column to show the correct sequence of events in the process. The first one has been done for you.

A sample of DNA is collected from an individual	1
Samples of DNA fragments are loaded into wells in the agarose gel using a micropipette	
An enzyme is used to create fragments of the DNA in the sample	
An electrical current is applied to the tank	

[2 marks]

[2 marks]

Question 2a

a)
The molecules named below are all required during the process of PCR.

Draw a line between the boxes to show the function for each of the molecules named.

Free nucleotides	To mark the start of the sequence to be copied
Primer	An enzyme required to build the new DNA fragments
Taq polymerase	The building blocks required to build the new DNA fragments

[3 marks]

[3 marks]

Question 2b

b)

State the property of Taq polymerase that makes it suitable for use in PCR.

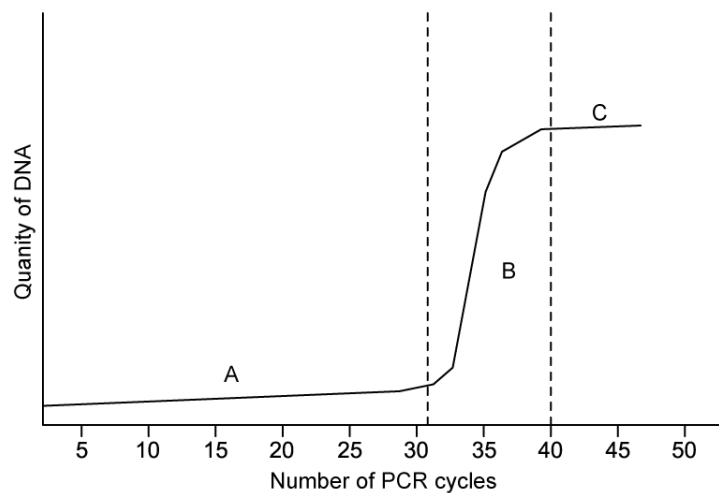
[1 mark]

[1 mark]

Question 2c

c)

The graph shows how the quantity of DNA increases over several cycles of PCR



Identify the stage of the graph where replication is exponential.

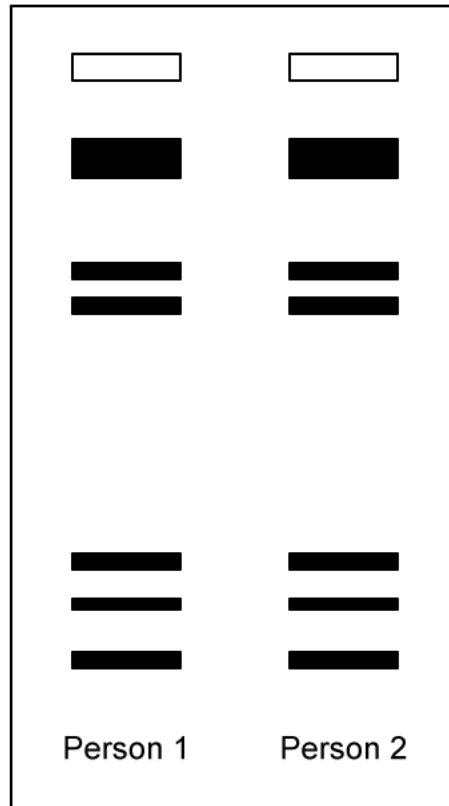
[1 mark]

[1 mark]

Question 2d

d)

The electrophoretogram shows a pattern produced from the DNA of two people.



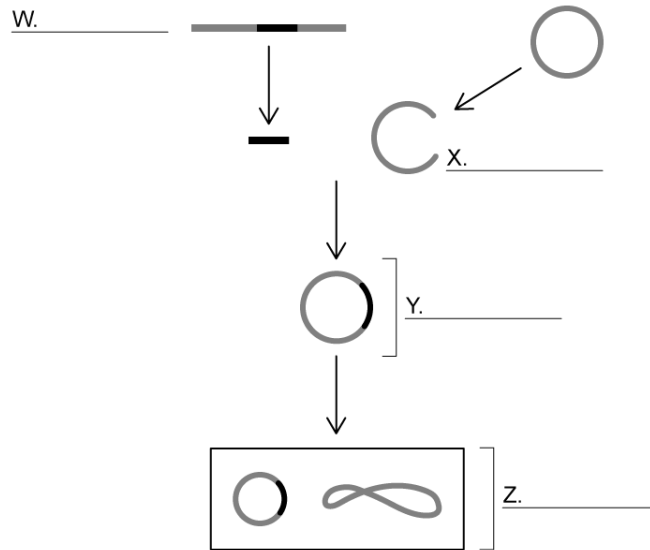
State how the electrophoretogram shows that the two people are identical twins.

[1 mark]

[1 mark]

Question 3a

a)
The diagram shows the process of genetic modification used to produce multiple copies of a required gene.



Label the diagram using the words provided.

Recombinant DNA Transgenic organism Plasmid Desired gene

[4 marks]

[4 marks]

Question 3b

b)
Identify the vector used in this genetic modification process.

[1 mark]

[1 mark]

Question 3c

c)

Gene transfer between organisms is possible due to the universal nature of the genetic code.

State what is meant by the term '**universal**'.

[1 mark]**[1 mark]****Question 3d**

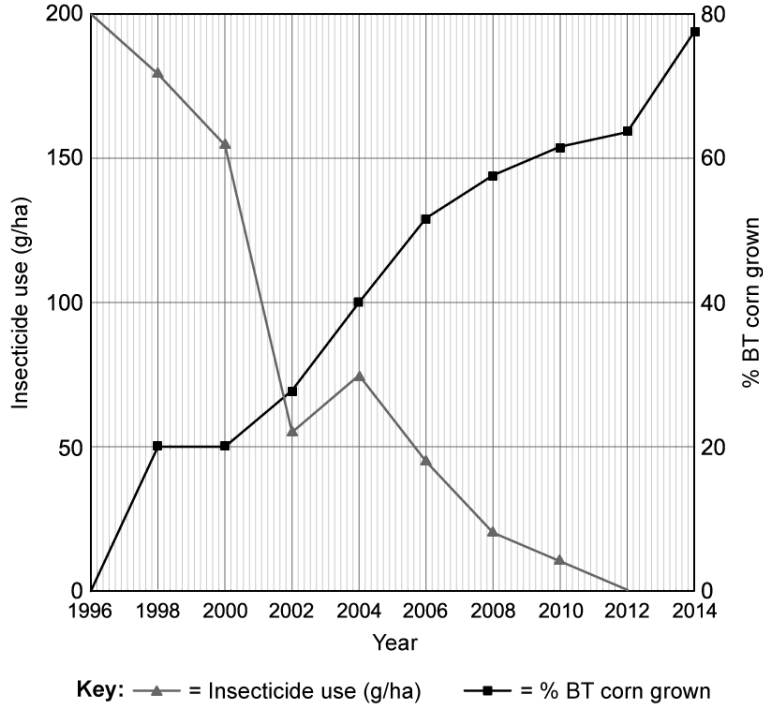
d)

Identify the enzyme used in recombinant DNA technology to cut out a desired gene at a specific base sequence resulting in the formation of sticky ends.

[1 mark]**[1 mark]**

Question 3e

e)
Crops can be genetically modified to include the BT toxin, a natural pesticide produced by a bacterium, *Bacillus thuringiensis*. The graph shows the changes in pesticide application in response to changes in the quantity of BT modified crops grown in the U.S.



Describe the effect that the increasing use of BT crops has on pesticide application.

[1 mark]

[1 mark]

Question 3f

f)
BT toxin has a negative impact on many types of insects, including those which do not feed on the crops such as bees, flies, beetles and butterflies.

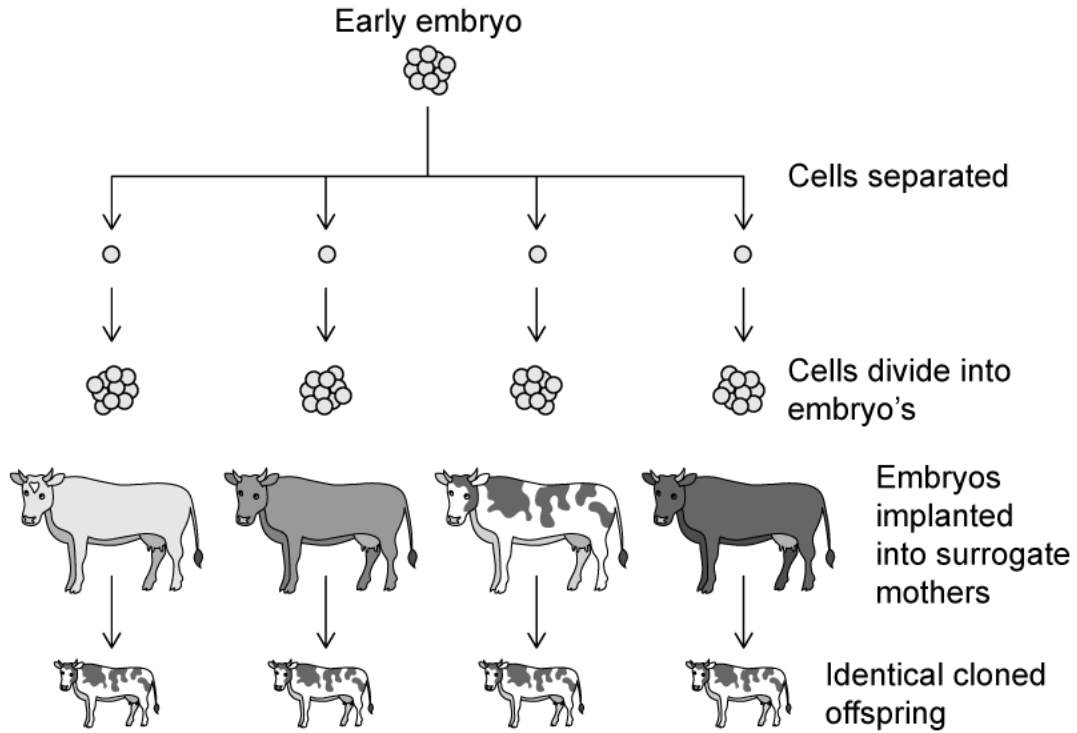
Suggest why there may be opposition to the use of BT corn by some.

[1 mark]

[1 mark]

Question 4a

a)
Identify the cloning process shown in the image.



[1 mark]

[1 mark]

Question 4b

b)
Complete the table by placing a (✓) or an (X) in the correct column to identify which methods of cloning are natural and which are artificial.

	Natural cloning	Artificial cloning
Parthenogenesis		
Somatic cell transfer		
Bulbs		
Rhizomes		
Cuttings		

[5 marks]

[5 marks]

Question 4c

c)

The cells of the early embryo are described as being pluripotent.

Define the term **pluripotent**.

[1 mark]

[1 mark]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Outline some of the concerns that people may have over the use of genetically modified crops in agriculture.

[4 marks]

[4 marks]

Question 5b

b)

Describe some of the potential benefits of genetic modification of crops.

[5 marks]**[5 marks]****Question 5c**

c)

Outline the process used to determine paternity using electrophoretograms produced in gel electrophoresis.

[3 marks]**[3 marks]**