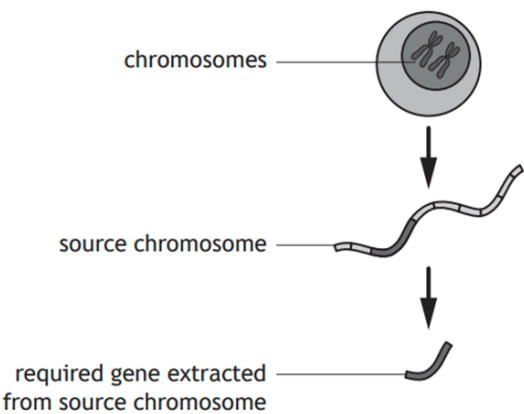


Genetic Engineering

1. The diagram shows part of the process of genetic engineering.



The extraction of the required gene from the source chromosome involves the use of

- A bacteria
- B hormones
- C plasmids
- D enzymes.

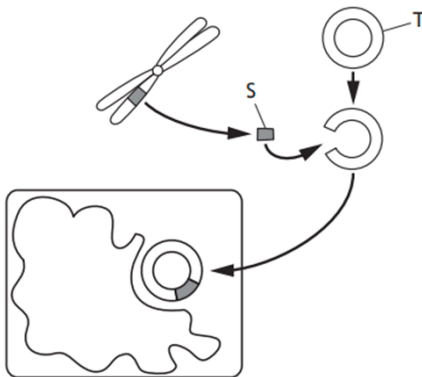
2. The following stages occur during the process of genetic engineering:

1. gene inserted into plasmid
2. plasmid cut open
3. plasmid extracted from bacterial cell
4. gene extracted from chromosome.

Which of the following shows the stages in the order they occur?

- A 2 → 4 → 1 → 3
- B 2 → 1 → 3 → 4
- C 4 → 2 → 1 → 3
- D 4 → 3 → 2 → 1

3. The diagram shows stages in the production of a substance by genetic engineering.



Which row in the table identifies S and T?

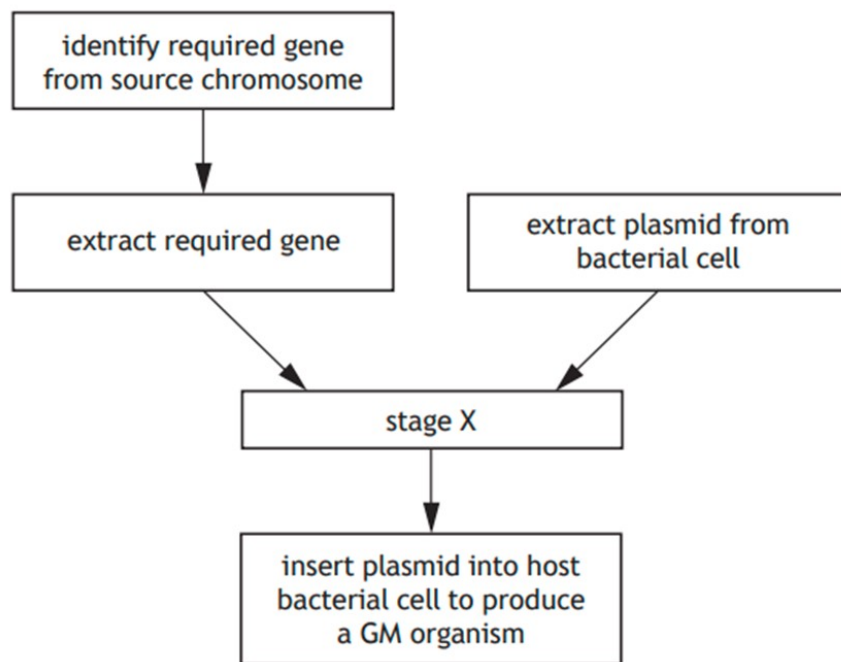
	S	T
A	Gene	Plasmid
B	Gene	Bacterium
C	Chromosome	Plasmid
D	Chromosome	Bacterium

4. Which row in the table identifies the order of stages involved in genetic engineering?

Stage in Genetic Engineering				
	1st	2nd	3rd	4th
A	Required gene identified	Gene and plasmid extracted	Gene inserted into plasmid	Modified cells grown
B	Required gene identified	Gene inserted into plasmid	Gene and plasmid extracted	Modified cells grown
C	Gene inserted into plasmid	Required gene identified	Modified cells grown	Gene and plasmid extracted
D	Gene inserted into plasmid	Modified cells grown	Gene and plasmid extracted	Required gene identified

Genetic Engineering

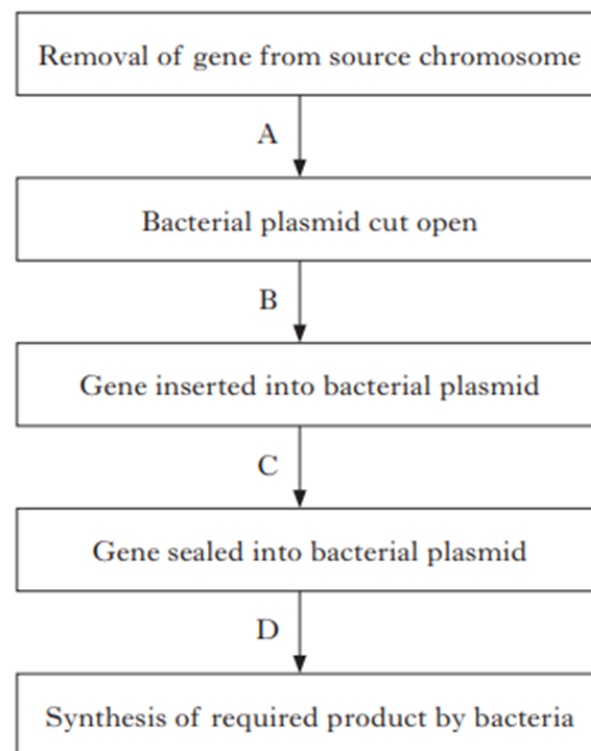
5. The flowchart represents some of the stages of genetic engineering.



A suitable description of stage X would be

- A insert bacterial plasmid into required gene
- B insert bacterial plasmid into source chromosome
- C insert required gene into host bacterial cell
- D insert required gene into bacterial plasmid.

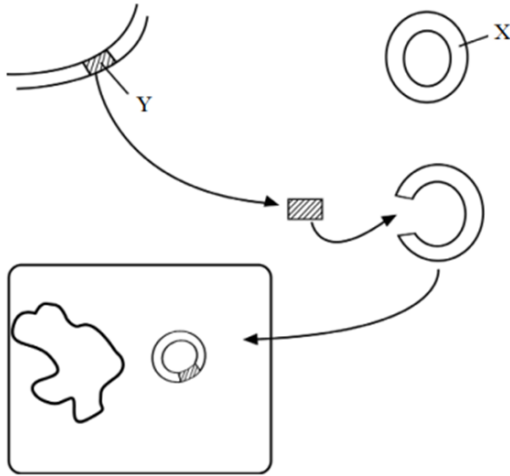
6. Some stages of genetic engineering are shown below.



Which letter indicates the stage where the plasmid is inserted into a bacterial cell?

Genetic Engineering

7. The diagram below shows stages in the production of a desired product by genetic engineering.



Which line in the table identifies correctly the structures labelled above?

	X	Y
A	bacterium	gene
B	plasmid	chromosome
C	bacterium	chromosome
D	plasmid	gene

8. Genetic engineering can be used to alter bacterial cells in order to produce human insulin.

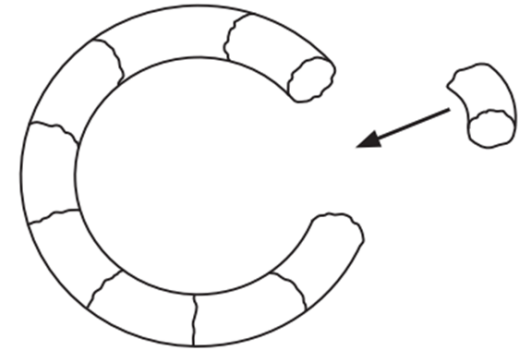
The stages in the process are:

- 1 insulin gene extracted from a human cell
- 2 bacteria divide and produce large quantities of human insulin
- 3 plasmid is removed from bacterial cell and "cut" open
- 4 insulin gene is inserted into bacterial plasmid.

The correct sequence of these stages is

- A 1, 3, 4, 2
- B 1, 3, 2, 4
- C 3, 4, 2, 1
- D 3, 1, 2, 4.

9. Which stage in the production of human insulin by genetic engineering is represented in the diagram below?



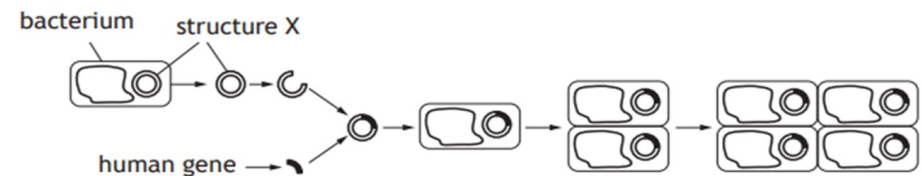
- A Human gene is inserted into a plasmid.
- B Human gene is inserted into a bacterium.
- C Plasmid is inserted into a human chromosome.
- D Bacterial gene is inserted into a human chromosome.

10. Arrange the following stages of genetic engineering in the correct order. The first stage has been given.

Stage number	Description of stage
1	Bacterial cell produces insulin
2	Insulin gene inserted into plasmid
3	Plasmid removed from bacterial cell
4	Plasmid inserted into bacterial cell
5	Insulin gene removed from human chromosome

Stage 5 → _____ → _____ → _____ → _____

11. The diagram below represents part of the process of genetic engineering.

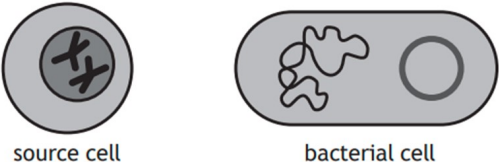


Structure X is removed from the bacterium and modified during this process.

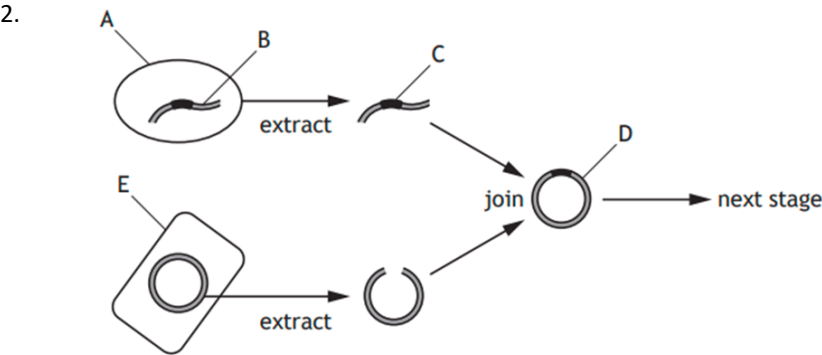
Name structure X.

Genetic Engineering

1. Scientists use bacteria to act as host cells, to produce enzymes commercially by the process of genetic engineering.



Name the structure in the source cell from which the required gene is extracted during the first stage of this process.

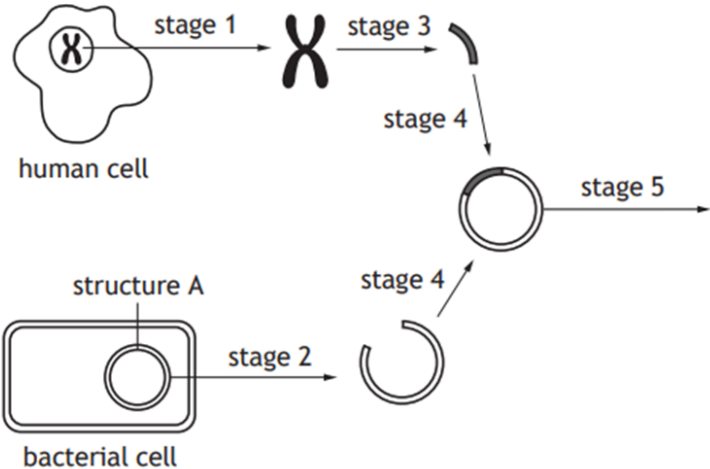


- (a) Using information from the diagram, complete the table.

Structure	Letter
Bacterial cell	
Gene for penicillin	
	D

- (b) Describe the next stage in the production of penicillin.

3. The diagram shows some of the stages in the transfer of a section of DNA from one cell to another.



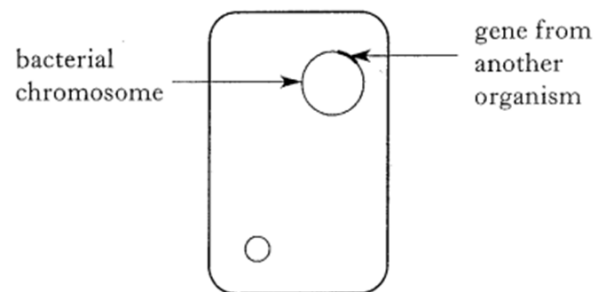
- (a) Name the process shown by the diagram.

- (b) Name structure A.

- 3 (c) Describe what happens during stage 5.

Genetic Engineering

4. The diagram below shows a genetically-engineered bacterial cell.



- (a) Name the type of molecule found in a bacterial chromosome.

1

- (b) The bacterium was genetically engineered to produce a particular substance.

Name one example of a substance which can be produced in this way and describe its use.

Substance _____

Use _____

1

5. (a) Genetic engineering is used to produce growth hormone.

The growth hormone gene is identified and removed from a human chromosome. This gene is then used in the genetic engineering process which involves a number of stages.

The table below shows the stages but they are not in the correct order.

Complete the table, entering a number (2 to 5) in each remaining box, to show the correct order for each stage.

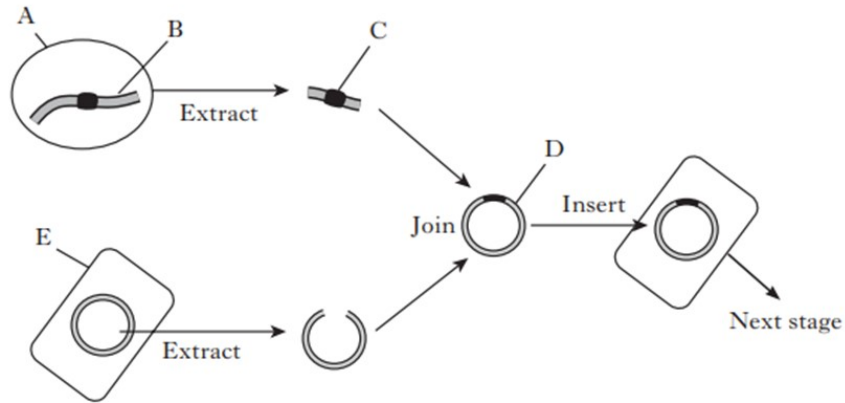
<i>Stages</i>	<i>Number</i>
bacterial plasmid cut open	
bacteria multiply and synthesise growth hormone	
growth hormone gene inserted into bacterial plasmid	
bacterial plasmid removed from bacterium	1
bacterial plasmid inserted into bacterium	

Genetic engineering can be used to transfer human genes to bacteria.

- (b) Name a human hormone which can be produced by genetically engineered bacteria.

Genetic Engineering

6



(a) Complete the table below to identify the labelled parts of the diagram.

Name of structure	Letter
bacterial cell	
insulin gene	
plasmid	

(b) Describe the next stage needed to produce insulin for use as a medicine.

(c) Name another human hormone produced by genetic engineering.

7. In the boxes below, describe each of the steps carried out to transfer successfully a human gene to a bacterial cell.

Step 1

Chromosome extracted from human cell and required gene located

Step 2

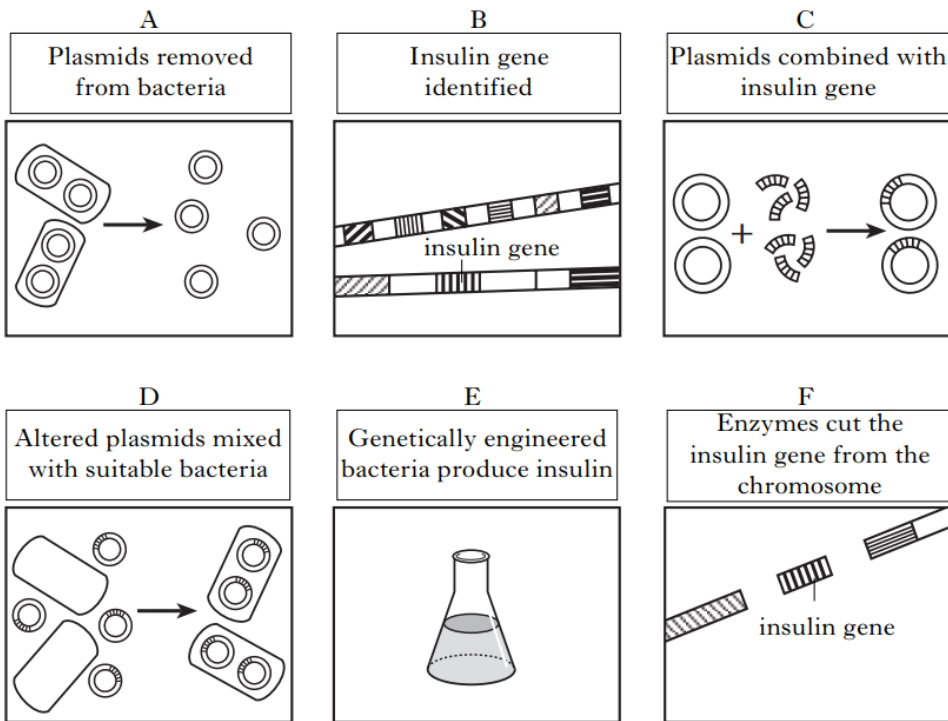
Step 3

Step 4

Grow large numbers of the bacteria now containing required human gene

Genetic Engineering

8. The diagrams show the production of insulin by genetic engineering. They are not in the correct order.



Use the letters to put the diagrams in the correct sequence.
The first and last have been done for you.



9. Insulin is used to treat people with diabetes. It can be manufactured by genetically-engineered bacteria using the steps described below.

- A Bacteria are grown in a fermenter and produce insulin.
- B The human insulin gene is isolated.
- C Plasmids are removed from bacteria.
- D Human insulin is purified and used to treat people with diabetes.
- E The human insulin gene is inserted into a plasmid.
- F Altered plasmids are put into bacteria.

Arrange the steps into the correct order by putting the appropriate letter into each empty box.



10. Describe the stages of the process that would be used to produce genetically engineered bacteria, after the required gene has been extracted from the source cell.

1

Genetic Engineering Answers

1. D
2. D
3. A
4. A
5. D
6. D
7. D
8. A
9. A
10. 3 - 2 - 4 - 1
11. plasmid

1. chromosome

2a)

Structure	Letter
Bacterial cell	E
Gene for penicillin	C
Plasmid	D

b) plasmid put into a different bacterial cell.

3a) genetic engineering

b) plasmid

b) plasmid put into a different bacterial cell.

4a) plasmid

b) Insulin: to treat diabetes OR Growth hormone: grow bones/muscles

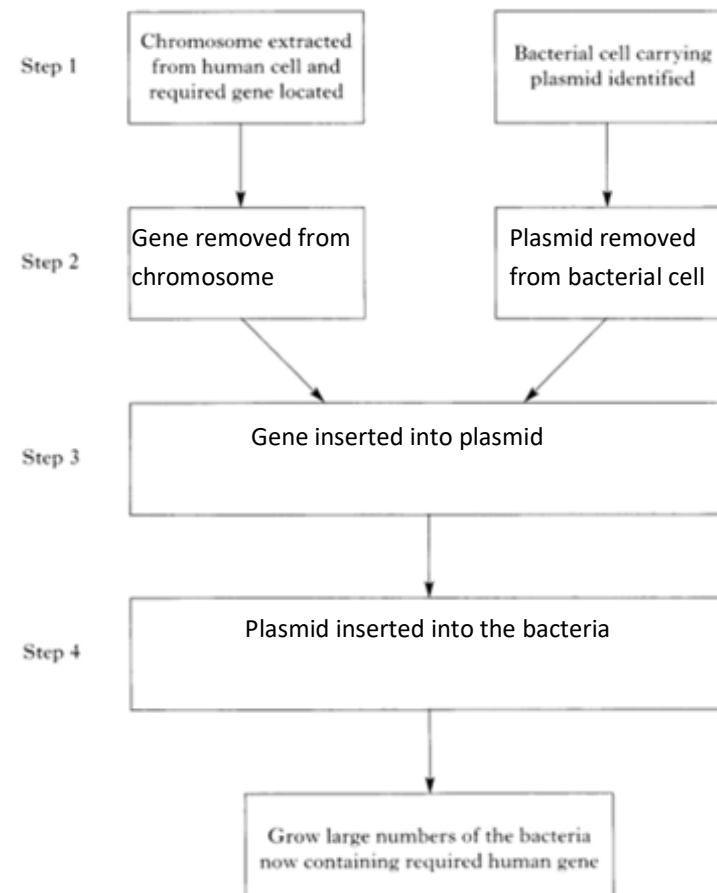
5a) 2 5 4 1 3 b) insulin/growth hormone

6a)

Name of structure	Letter
bacterial cell	E
insulin gene	C
plasmid	D

b) bacteria multiply & produce insulin/
growth hormone.

7.

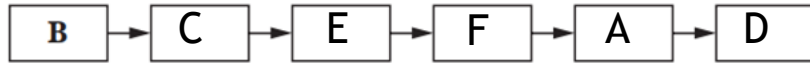


Genetic Engineering Answers

8.



9.



10.

1. Plasmid extracted from bacteria/bacterial cell

OR

Plasmid cut open (1)

2. (Required) gene inserted into plasmid

(1)

3. (Modified) plasmid inserted into a bacterial/host cell

(1)

4. A correct mention of enzyme cutting plasmid

OR

Sealing gene into plasmid (1)