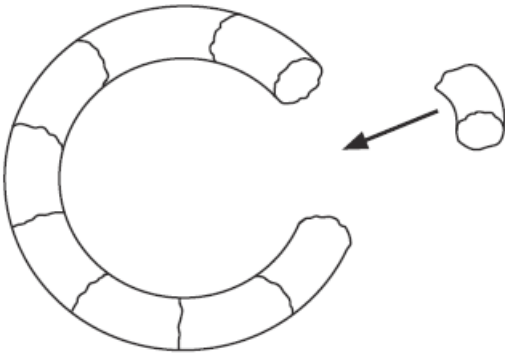


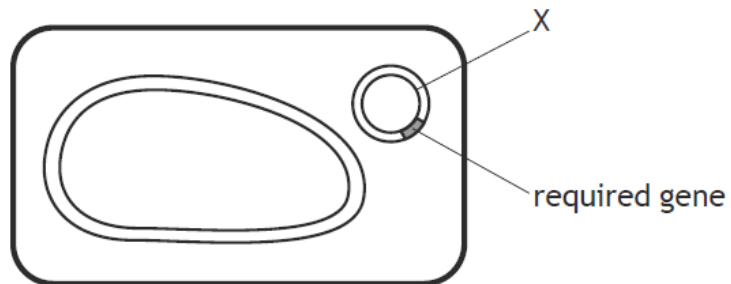
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Which stage in the production of human insulin by genetic engineering is represented in the diagram below?



- 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.

The diagram below represents a genetically engineered bacterial cell.

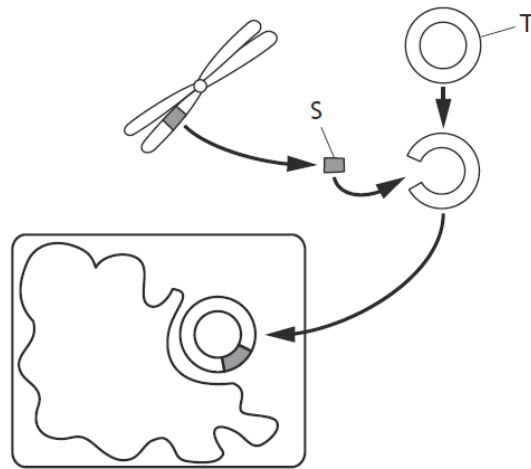


The structure labelled X is a

- A chromosome
- B plasmid
- C ribosome
- D nucleus.

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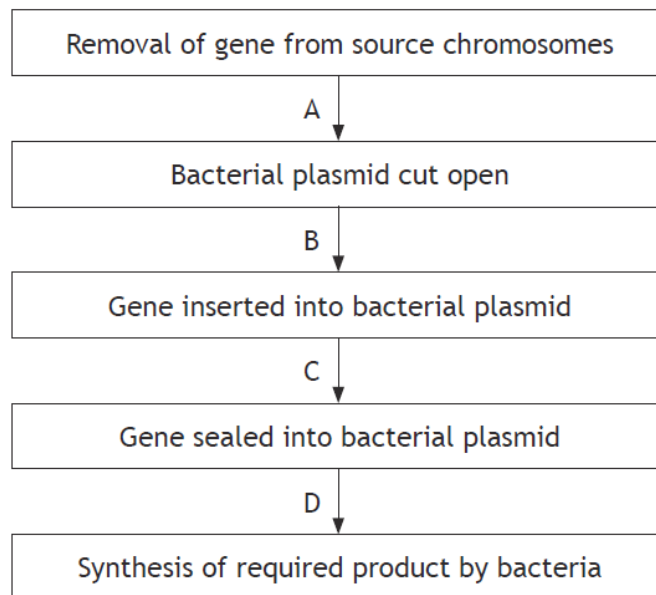
The diagram below shows stages in the production of a substance, such as insulin, by genetic engineering.



Which line in the table below correctly identifies S and T?

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

Some stages of genetic engineering are shown below.

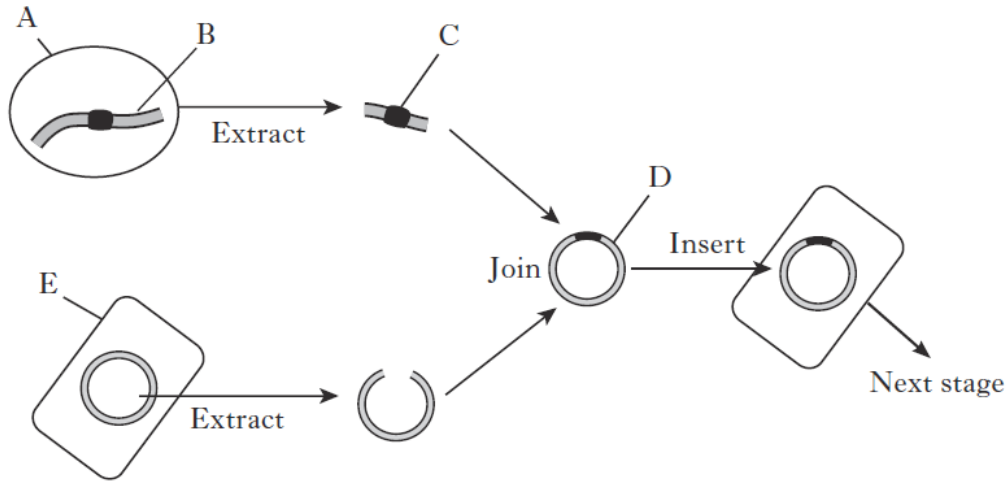


Which letter indicates the stage where the plasmid is inserted into a bacterial cell?

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1/10/16/3

The diagram below represents some of the stages of genetic engineering which are used to produce medicines such as insulin for human use.



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

<i>Name of structure</i>	<i>Letter</i>
bacterial cell	
insulin gene	
plasmid	

2

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

1

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

1

(d) State **one** advantage of genetic engineering.

1

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(a) 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.



1

The sentence below describes the function of DNA.

Underline one option in each set of brackets to make the following sentence correct.

The $\left\{ \begin{array}{l} \text{number} \\ \text{order} \end{array} \right\}$ of DNA $\left\{ \begin{array}{l} \text{bases} \\ \text{genes} \end{array} \right\}$ in a chromosome encodes information

for the structure of a $\left\{ \begin{array}{l} \text{carbohydrate} \\ \text{protein} \end{array} \right\}$.

2

Underline one option in each set of brackets to make the following sentences correct.

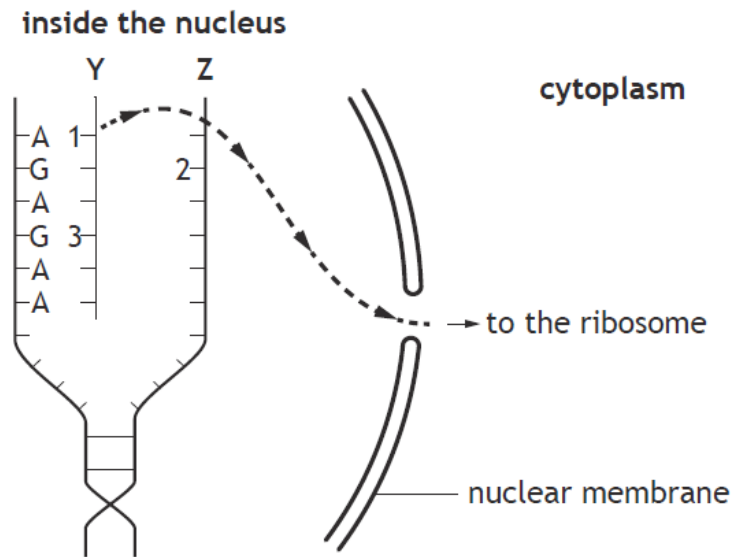
Chromosomes are made of DNA. The chain of $\left\{ \begin{array}{l} \text{acids} \\ \text{bases} \end{array} \right\}$ in DNA

code for $\left\{ \begin{array}{l} \text{amino acids} \\ \text{fatty acids} \end{array} \right\}$ in $\left\{ \begin{array}{l} \text{fats} \\ \text{proteins} \end{array} \right\}$.

2

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The diagram below shows how genetic information in the nucleus is used in the first stage of making a protein.



(a) (i) Name molecule Y. 1

(ii) Underline one option in each bracket to make the following sentences correct. 2

1. The molecules represented by the letter A are }
 - bases
 - genes
 - proteins

2. The complementary strand Z would have the letter }
 - A
 - C
 - G
 - T

(b) Name the basic units which are joined together to make a protein at the ribosome. 1

(c) The diagram above shows a section of the code to make a protein such as amylase. Describe how the code to make the protein insulin would differ from this. 1

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- (a) DNA is a double stranded molecule. The following diagram shows part of one strand. Complete the diagram to show the complementary strand.

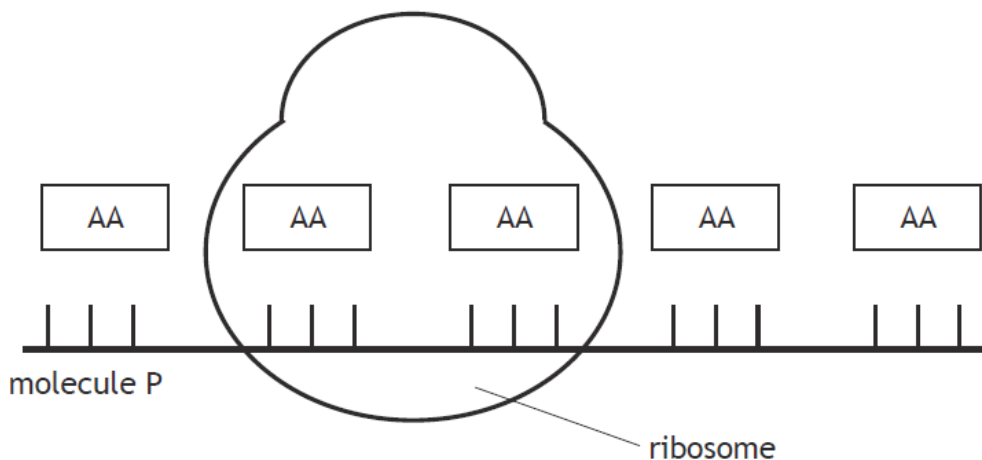


1

- (b) (i) DNA contains genetic material which controls the synthesis of chemicals made from amino acids.
 Name the type of chemicals synthesised.

1

- (ii) The diagram below shows an example of one of these chemicals being synthesised.



Name molecule P and describe how it determines the sequence of amino acids, represented by AA, as shown in the diagram.

2

Molecule P _____

Description _____

- (iii) Name the part of the cell where molecule P was made.

1
