

1 Crop production in many areas of the world needs the application of large volumes of water. However, when the water evaporates from the soil, traces of salts are left behind. After several years, the soil becomes too salty for most plants to grow in it.

**(a) (i)** State three functions of water in plants.

1. .... [3]
2. ....
3. .... [3]

**(ii)** With reference to the water potential gradient, explain why plants may die when grown in salty soil.

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

**(b)** Some plants are able to pump salts out of their roots.

**(i)** Name the process plants could use to pump salts out of their roots.

..... [1]

**(ii)** Suggest how the process named in **(i)** could affect the rate of growth of the plants if the process was operating all the time.

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

**(iii)** Plants need mineral salts for normal, healthy growth. Complete the table by naming two minerals that plants need and stating their functions.

mineral		function
1	.....	..... .....
2	.....	..... .....

[4]

- (c) An article in a school science magazine stated, ‘Many plants contain genes which enable them to pump salts out of their roots. These genes can be made more active by genetic engineering, enabling the plants to remove salts before the plants are damaged.’

Explain whether you think that the process described in the article above **is** an example of genetic engineering.

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

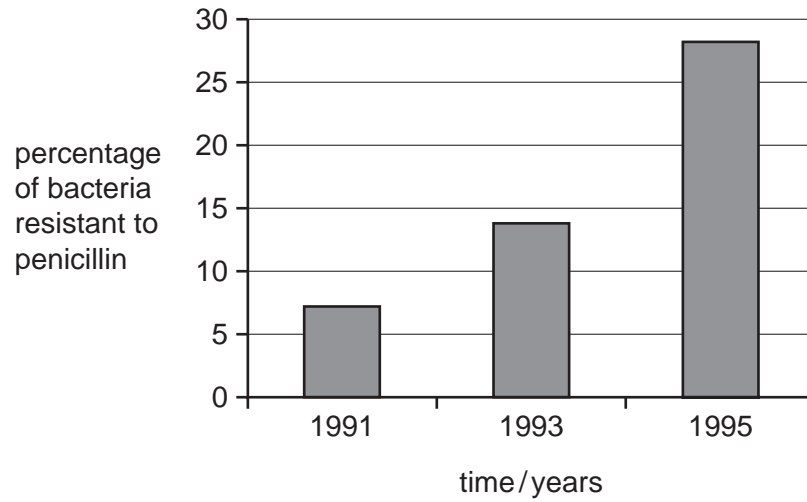
- (d) Some scientists believe that washing the salts out of the soil using even more water is a better alternative to genetic engineering.

State two problems that could be caused by washing the soil with extra water.

1. ....  
2. .... [2]

[Total:18]

- 2 Fig. 4.1 shows the change in percentage of disease-causing bacteria that were resistant to the antibiotic penicillin from 1991 to 1995.



**Fig. 4.1**

- (a) (i) Describe the change in the percentage of bacteria resistant to penicillin between 1991 and 1995.

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

- (ii) Explain how a population of antibiotic-resistant bacteria can develop.

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

(b) Although bacteria can cause disease, many species are useful in processes such as food production and maintaining soil fertility.

(i) Name **one** type of food produced using bacteria.

..... [1]

(ii) Outline the role of bacteria in maintaining soil fertility.

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

(c) Bacteria are also used in genetic engineering.

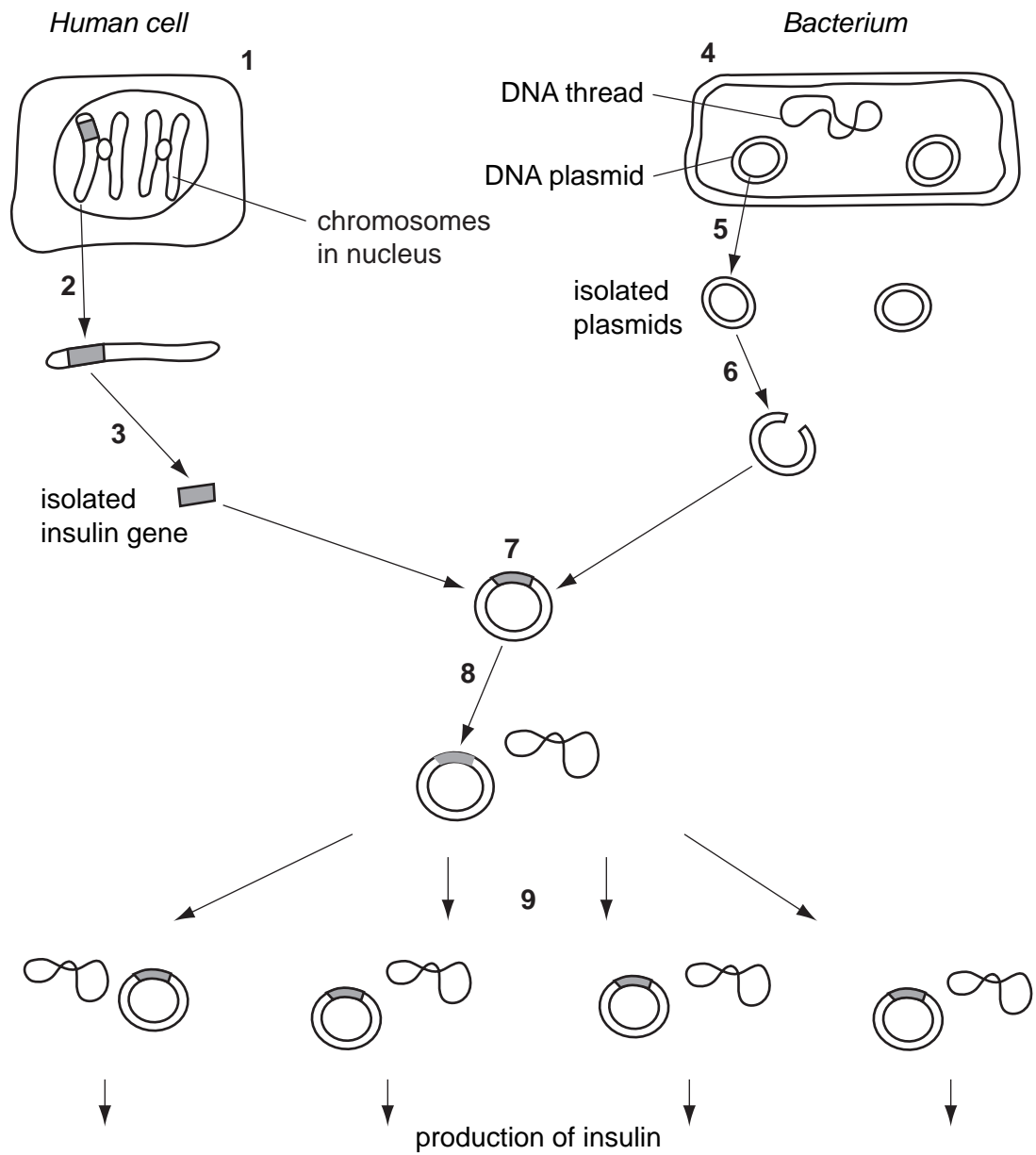


Fig. 4.2

Complete the table below by identifying **one** of the stages shown in Fig. 4.2 that matches **each** description.

description of the stage	number of the stage
the plasmids are removed from the bacterial cell	.....
a chromosome is removed from a healthy human cell	.....
plasmids are returned to the bacterial cell	.....
restriction endonuclease enzyme is used	.....
bacterial cells are allowed to reproduce in a fermenter	.....

[5]

[Total: 15]

3 If the glucose in the blood rises above its normal concentration, insulin is secreted to bring the concentration back to normal.

(a) (i) Suggest one explanation for a rise in the concentration of glucose in the blood.

..... [1]

(ii) Name the organ that secretes insulin.

..... [1]

(iii) Describe the role of the liver in bringing the concentration of glucose in the blood back to normal.

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

(iv) State the term that describes how a substance, such as glucose, in the body is maintained at a constant level.

..... [1]

(b) Diabetics are unable to control their blood glucose levels naturally.

Human insulin can now be made using bacteria that have been genetically engineered.

(i) Insulin is a protein. Suggest why insulin has to be injected rather than taken by mouth.

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

(ii) Explain how bacteria can be genetically engineered and used to make human insulin.

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

[Total: 11]