Biotechnology and genetic modification – 2021 IGCSE 0610

1. March/2021/Paper_12/No.39

Rice has been modified by adding genes from bacteria and another plant so that it can produce the nutrient beta carotene.

What is this process called?

A evolution

B genetic engineering

C mutation

D selective breeding

2. June/2021/Paper_12/No.39

Bacteria are useful in ……X…… because of their rapid ……Y…… rate and their ability to make complex ……Z…… .

Which row completes the sentence?

	X	Y	Z
A	bread making	competition	chemicals
B	biotechnology	reproduction	molecules
C	ethanol production	competition	enzymes
D	genetic engineering	production	pectinase

3. June/2021/Paper_13/No.39

What is an example of genetic engineering?

A the addition of vitamins to food to increase the nutritional benefits

B the breeding of sheep with thick wool by choosing animals with desired characteristics

C the insertion of genes into crop plants to make them resistant to insect pests

D the production of biofuels by yeast cells

4. June/2021/Paper_21/No.39

Why are bacteria useful in genetic engineering?

A Their genetic code is different to other organisms.

B They have cell walls.

C They have plasmids.

D They reproduce sexually.

5. June/2021/Paper_22/No.39

Bacteria can be used to make human proteins.

Which statement explains why this is possible when a human gene is placed in a bacterial cell?

A Bacteria are able to reproduce rapidly.

B Bacteria are very small organisms.

C Bacteria contain genetic material in plasmids.

D Bacteria have the same genetic code as humans.

6. June2021/Paper_41/No.3

Bacteria are used in many biotechnological processes.

(a) Explain why bacteria are useful in biotechnology.

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..... [3]

(b) Insulin is one of many human proteins that are made by genetically engineered bacteria.

Some people cannot produce insulin because their immune system has destroyed the cells that make insulin.

(i) State the organ that contains the cells that have been destroyed.

..... [1]

(ii) State the name of the disease caused by the destruction of these cells.

..... [1]

(iii) State the function of insulin in the body.

..... [1]

(c) Genetically engineered bacteria that are used to make insulin were grown in a fermenter for five days.

Samples were taken from the fermenter every six hours and the number of bacteria in 1.0 mm^3 of the nutrient solution were counted.

Changes in the numbers of living bacteria in the samples taken from the fermenter are shown in Fig. 3.1.

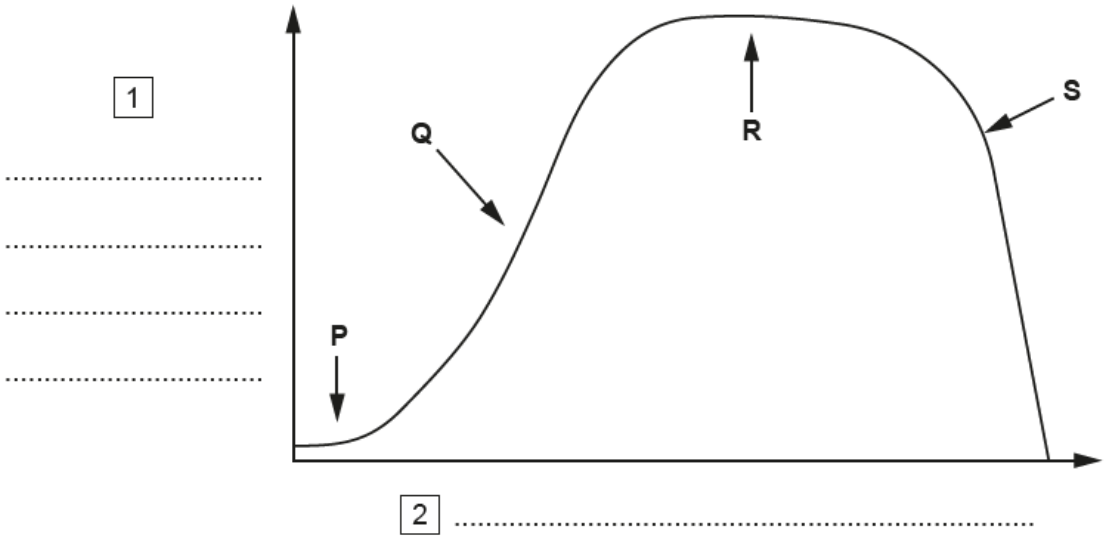

Fig. 3.1

(i) Complete Fig. 3.1 by adding labels for the axes at 1 and 2. [1]

(ii) State the names of the stages of population growth of the bacteria labelled **P** to **S**.

P .....

Q .....

R .....

S .....

[2]

(iii) Explain, with reference to Fig. 3.1, why the bacteria did not grow in the fermenter for longer than five days.

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..... [3]

(d) Mineral salts are important in the human diet. One of the most important is iron.

Explain:

- the importance of iron in the human diet
- the effects of an iron deficiency.

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..... [3]

(e) Fig. 3.2 shows a field of cassava, *Manihot esculenta*, which is a crop plant grown in parts of Africa and Asia.

Fig. 3.2

The plants store starch in their roots, which form a large part of the diet for many people. Cassava does not provide many vitamins or mineral ions.

Genetic engineers have modified cassava to increase its iron content. They have done this by incorporating a gene for a membrane protein from the plant *Arabidopsis thaliana*.

(i) State the name of the enzyme that is used to cut out the gene from the DNA of *A. thaliana*.

..... [1]

(ii) Describe how the gene from *A. thaliana* and the DNA from cassava form recombinant DNA.

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..... [2]

(iii) Scientists who develop genetically engineered varieties of crop plants often breed them for several generations before releasing them for farmers to use.

Suggest why the scientists do this.

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..... [2]

[Total: 20]