21. Biotechnology and genetic modification

21.2 Biotechnology

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates

1 **(a)** A scientist investigated the effect of the enzyme pectinase on the volume of fruit juice produced by the same mass of two different fruits.

Fig. 7.1 shows the results.

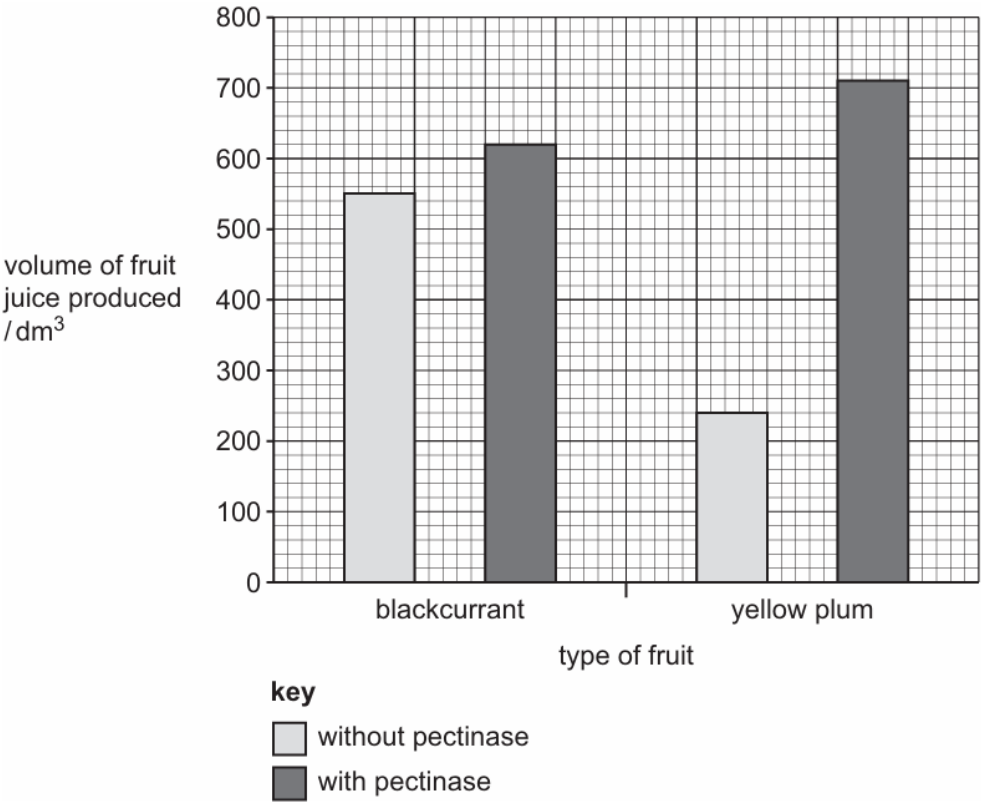

Fig. 7.1

Describe the results shown in Fig. 7.1.

.....

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.....

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.....

.....

..... [3]

(b) State **two** components of a balanced diet that are provided by fruits such as blackcurrants and plums.

1 .....

2 .....

[2]

2 **(c)** Pectinase is an example of a type of protein.

State the name of this type of protein.

..... [1]

(d) Fig. 8.2 shows the process used to produce clear fruit juice.

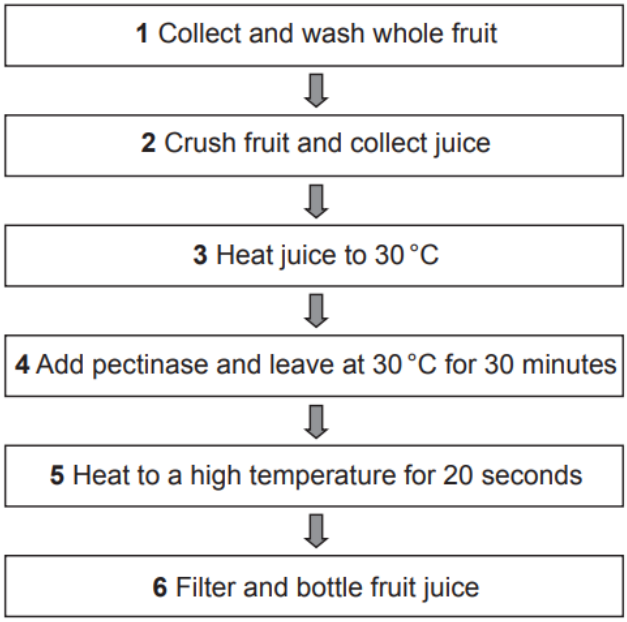

Fig. 8.2

(i) Explain why a temperature of 30 °C is used in step **4**.

.....

.....

..... [1]

(ii) During step **4** amylase may be added to the fruit juice.

Suggest the purpose of adding amylase.

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.....

..... [1]

(iii) Explain why the juice is heated to a high temperature in step **5**.

.....

.....

..... [1]

(e) Yeast is used in biotechnology.

Circle **two** uses of the products of anaerobic respiration in yeast.

biofuels **bread-making** **herbicide production**

insulin production **lactic acid production** **washing powders**

[2]

3 **(a)** A student investigated the effect of different concentrations of pectinase on the volume of apple juice produced.

$1\,cm^3$ of pectinase solution was added to 5 g of mashed apples and the volume of apple juice produced was recorded. Six different concentrations of pectinase solution were tested.

The results are shown in Table 7.1.

Table 7.1

percentage concentration of pectinase solution	volume of apple juice produced / cm^3
0	4.4
5	5.0
10	5.4
15	5.8
20	
25	7.4

(i) Predict the volume of apple juice produced using pectinase solution with a concentration of 20%.

..... cm^3 [1]

(ii) Calculate the percentage increase in the volume of apple juice produced when the concentration of pectinase solution increased from 0% to 10%.

Space for working.

.....%
[2]

4 **(e)** Bacteria are often used in biotechnology.

Complete the sentences using words from the list to explain why bacteria are used.

Each word may be used once, more than once or not at all.

complex	**genetic**	**identical**	**non-identical**
physical	**rapid**	**slow**	**simple**

Bacteria are useful in biotechnology and ..... engineering due to their ..... reproduction rate and their ability to make ..... molecules.

[3]

Paper 4

Questions are applicable for extended candidates only

5 Penicillin can be produced in fermenters.

(a) State the name of the type of organism that produces penicillin.

..... [1]

(b) Fig. 6.1 shows the change in biomass of the organism that produces penicillin, when grown in a fermenter under controlled conditions. **(extended only)**

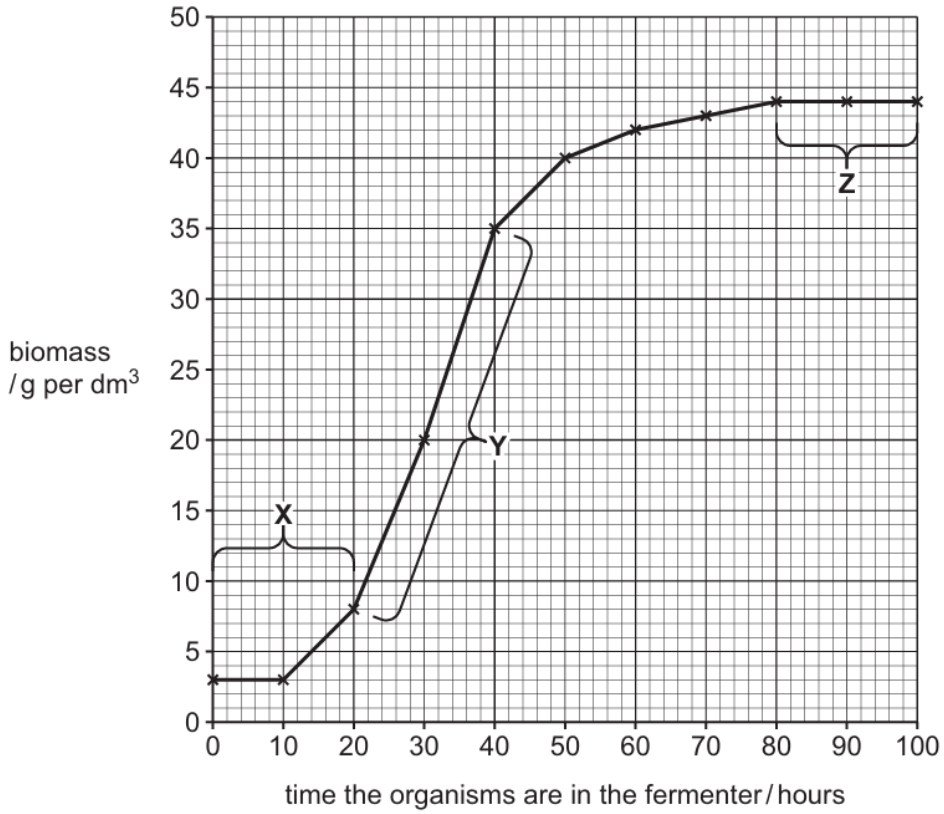

Fig. 6.1

State the name of the growth stages of the organism, shown by the letters **X**, **Y** and **Z** in Fig. 6.1.

X .....

Y .....

Z .....

[3]

(c) Fig. 6.2 is a diagram of a fermenter containing the organisms that produce penicillin. **(extended only)**

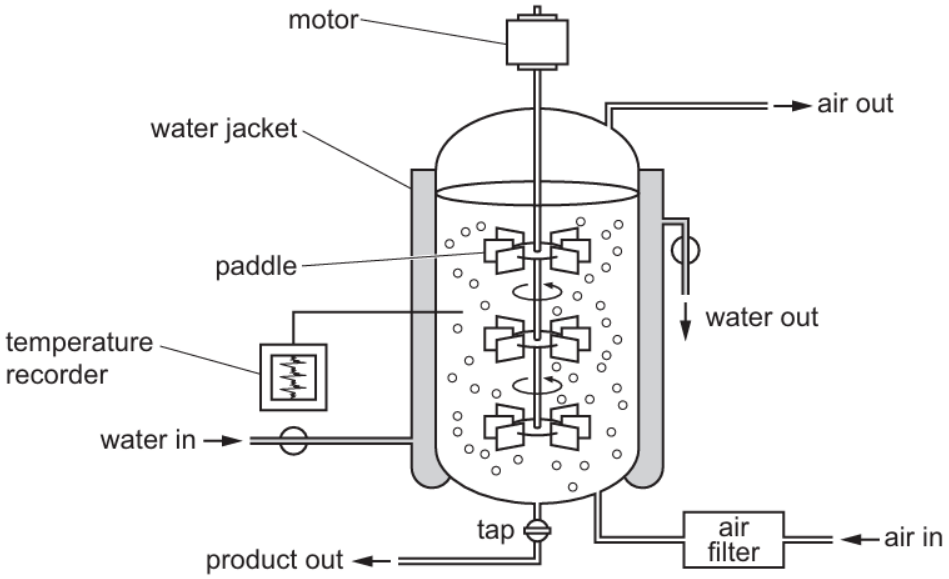

Fig. 6.2

(i) Explain why air is supplied to the fermenter shown in Fig. 6.2.

.....

.....

.....

.....

..... [2]

(ii) Explain why the temperature in the fermenter must be controlled.

.....

.....

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.....

.....

..... [3]

(iii) State the role of the paddles in the fermenter.

.....

.....

.....

.....

..... [2]

(iv) Other than penicillin, state the names of **two** commercial products that can be made using fermenters.

1 .....

2 .....

[2]

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

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.

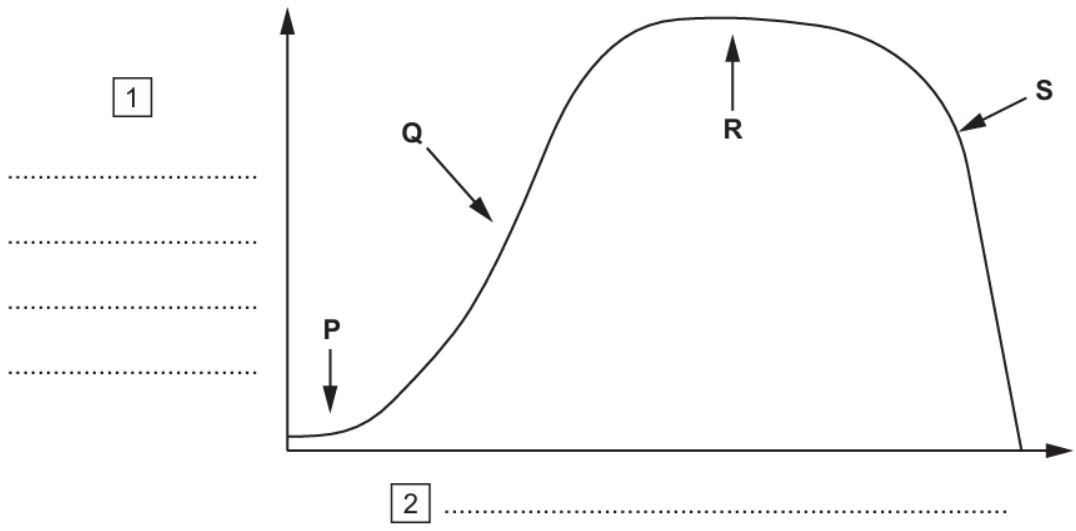

Fig. 3.1

(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.

.....

.....

.....

.....

.....

.....

..... [3]

7 **(d)** Genetically modified bacteria are often grown in fermenters. **(extended only)**

(i) Suggest why steam is used to clean fermenters.

.....

.....

..... [2]

(ii) State **three** conditions inside a fermenter that are measured and controlled.

1 .....

2 .....

3 .....

[3]

(iii) State the name of **one** commercial product, **other than** insulin, that is made in fermenters.

..... [1]