AQA – Genetic information, variation and relationships between organisms – A2 Biology

1. June/2021/Paper_1/No.5

0 5 . 1 Describe how a sample of chloroplasts could be isolated from leaves.

[4 marks]

0 5 . 2 Scientists grew two groups of plants:

- control plants with all the inorganic ions needed
- iron-deficient plants with all the inorganic ions needed **but** without iron ions.

After 1 week, the scientists measured the mass of protein and the mass of chlorophyll in the chloroplasts isolated from samples of leaves of these two groups of plants.

Table 4 shows the scientists' results.

Table 4

Mass of protein / percentage of control	Mass of chlorophyll / percentage of control
40	10

Some proteins found inside the chloroplast are synthesised inside the chloroplast.

Give **one** feature of the chloroplast that allows protein to be synthesised inside the chloroplast **and** describe **one** difference between this feature in the chloroplast and similar features in the rest of the cell.

[2 marks]

Feature _____

Structural difference _____

_____

0 5 . 3 The ratio of protein to chlorophyll in control plants is 9:1

Use the information in **Table 4** to calculate the ratio of protein to chlorophyll in iron-deficient plants.

[1 mark]

Ratio _____

0 5 . 4 The scientists also observed the chloroplasts from the samples of leaves using an electron microscope.

Figure 6 shows a chloroplast from a control plant (image **A**) and a chloroplast from an iron-deficient plant (image **B**).

Figure 6

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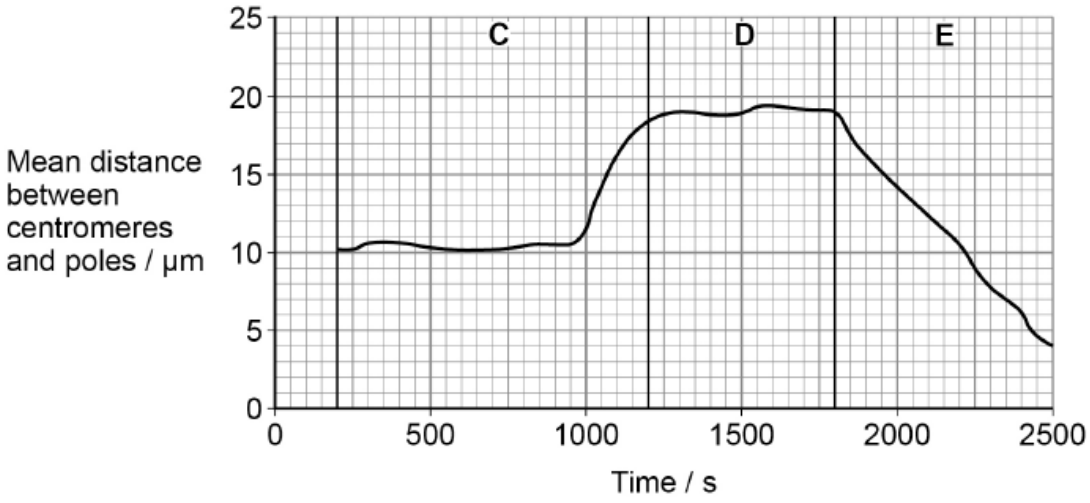
Use **Figure 6** to suggest why iron-deficient plants have a reduced growth rate.

[3 marks]

2. June/2021/Paper_1/No.6

0 6 . 1 **Figure 7** shows the mean distance between centromeres and the poles (ends) of the spindle during mitosis.

Figure 7



Calculate the rate of movement of the centromeres during phase **E**.

Give your answer in µm minute^{-1} **and** to 3 decimal places.

[2 marks]

_____ µm minute^{-1}

0 6 . 2 Name the three phases of mitosis shown by **C**, **D** and **E** on **Figure 7**.

Describe the role of the spindle fibres and the behaviour of the chromosomes during each of these phases.

[5 marks]

C _____

D _____

E _____

3. June/2021/Paper_1/No.9

0 9 . 1 Complete **Table 7** with ticks (✓) to show which elements are found in the following biological molecules.

[2 marks]

Table 7

Biological molecules	**Element**			
	Carbon	Nitrogen	Oxygen	Phosphorus
Galactose				
Phospholipid				
RNA				
Sucrose				

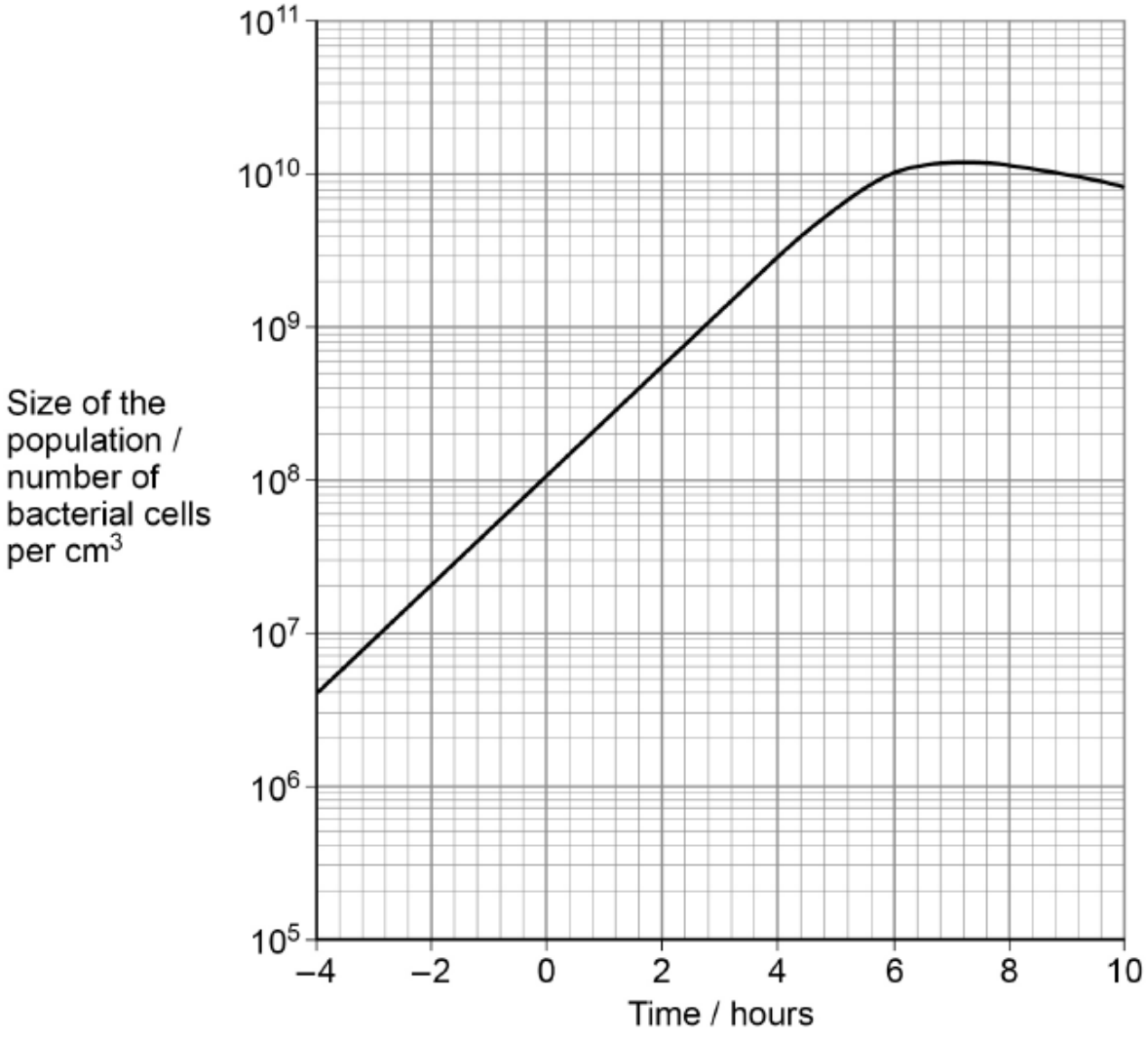
After Watson and Crick proposed the model of DNA structure, scientists investigated the possible mechanisms for DNA replication.

Two scientists grew a bacterial population, providing them with a nitrogen source containing only the heavy isotope of nitrogen, ^{15}N. As soon as all the DNA in this population contained ^{15}N, the scientists changed the nitrogen source to one containing only the lighter isotope of nitrogen, ^{14}N. They changed the nitrogen source at 0 hours.

During the investigation, the scientists measured the size of the population of bacterial cells.

Figure 11 shows the scientists' results.

Figure 11



0 9 . 2 The generation time for a population of bacteria is the time taken for all the bacteria to divide once by binary fission.

Use **Figure 11** and the following equation to calculate the generation time for this population of bacteria. Give your answer in hours.

[2 marks]

$$\text{Number of generations} = \frac{\log_{10}\left(\frac{\text{size of population at time } +4 \text{ hours}}{\text{size of population at time } -4 \text{ hours}}\right)}{\log_{10} 2}$$

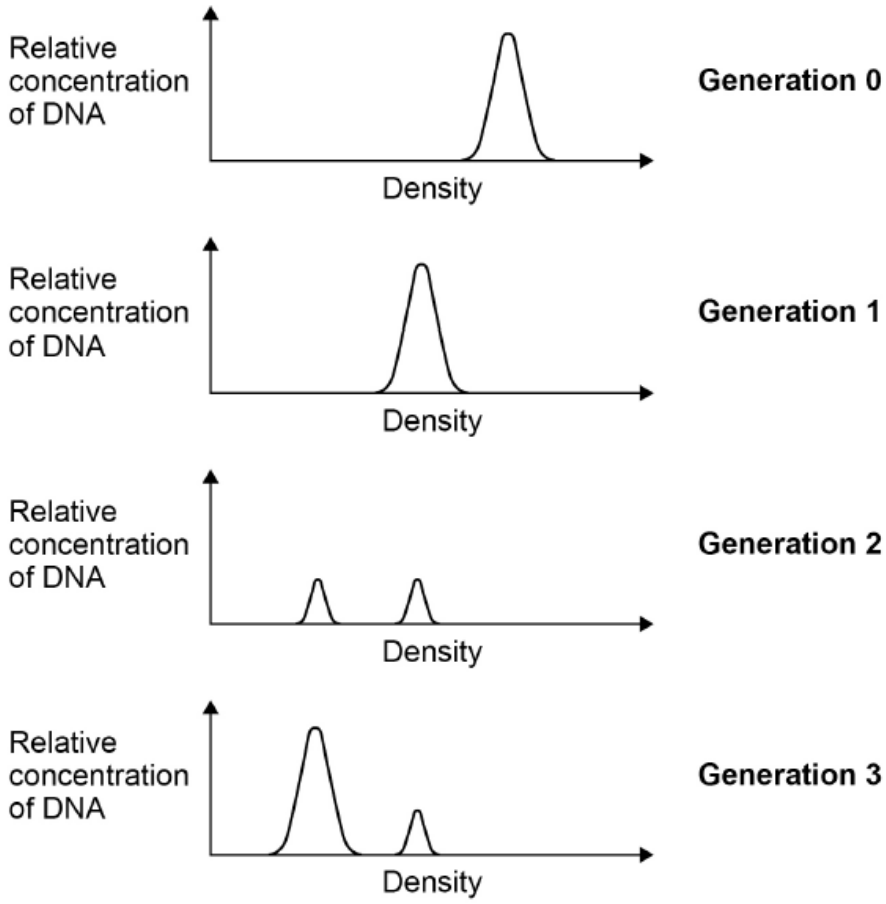
Generation time _____ hours

At intervals during this investigation, the scientists removed samples of the bacterial population, isolated the DNA and measured the density of the DNA.

DNA made using ^{15}N has a higher density than DNA made using ^{14}N.

Figure 12 shows the scientists' results.

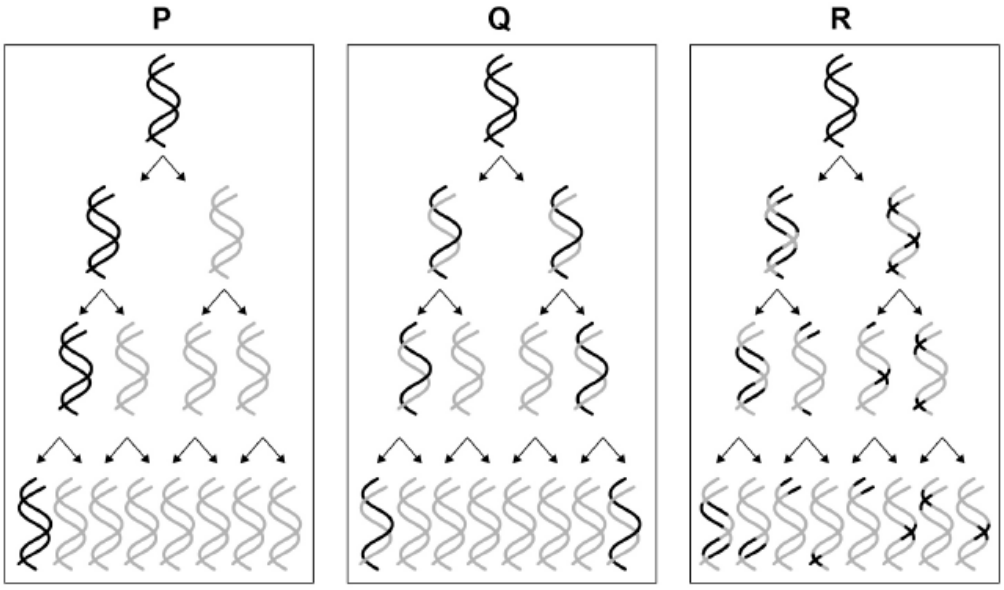
Figure 12



There are **three** possible models of DNA replication.

These models are shown in **Figure 13**.

Figure 13



0 9 . 3 Which of these models, **P**, **Q** or **R**, is supported by the results shown in **Figure 12**?

Give the letter and name of the model supported and explain why the results do **not** support the other models.

[3 marks]

Model _____

Name _____

Explanation for first **unsupported** model _____

_____

Explanation for second **unsupported** model _____

_____

4. June/2021/Paper_1/No.10

1 0 . 1 Describe the structure of DNA.

[5 marks]

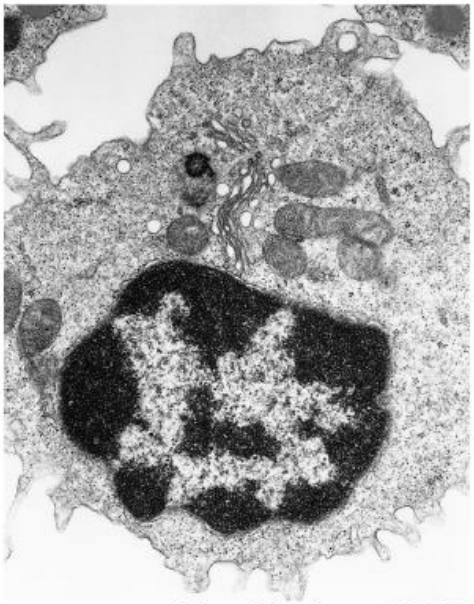
1 0 . 2 Name **and** describe **five** ways substances can move across the cell-surface membrane into a cell.

[5 marks]

Figure 14 shows transmission electron micrographs of two cells, one animal cell and one prokaryotic cell.

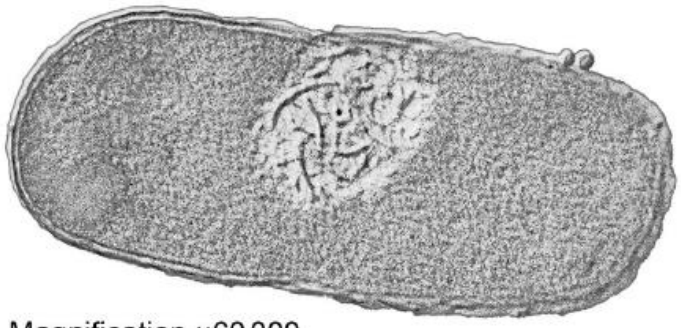
Figure 14

Cell A



Magnification ×30 000

Cell B



Magnification ×60 000

1 0 . 3 Contrast the structure of the two cells visible in the electron micrographs shown in **Figure 14**.

[5 marks]