

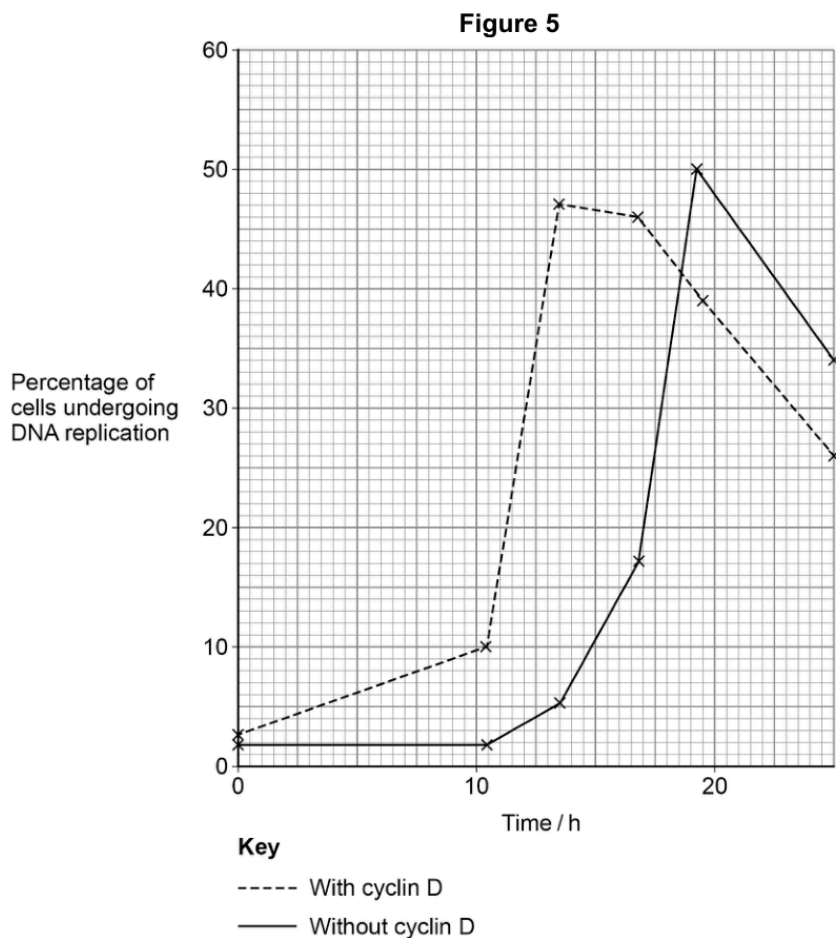
Cell division

4 questions · 34 marks

Answer all questions. The marks available are shown against each part. Every question is taken unaltered from a past paper; the source is noted beneath it.

1. 1 Describe the role of DNA polymerase in the semi-conservative replication of DNA. 8 marks
[2 marks]

Figure 5 shows the percentage of rat cells undergoing DNA replication. Some cells contained a protein called cyclin D and some cells did not contain cyclin D. All cells were in early interphase at time 0



2

It took less time for 25% of cells with cyclin D to be undergoing DNA replication than for 25% of cells without cyclin D.

Use **Figure 5** to calculate this time difference as a percentage decrease.

Show your working.

[2 marks]

Answer

%

3

Cyclin D stimulates the phosphorylation of DNA polymerase, which activates the DNA polymerase.

Describe how an enzyme can be phosphorylated.

[2 marks]

4

Some tumour cells contain higher than normal concentrations of cyclin D.

Use **Figure 5** to suggest why higher than normal concentrations of cyclin D could result in a tumour.

[2 marks]

AQA 7402/1 Biology · June 2020 · Paper 1, Question 5

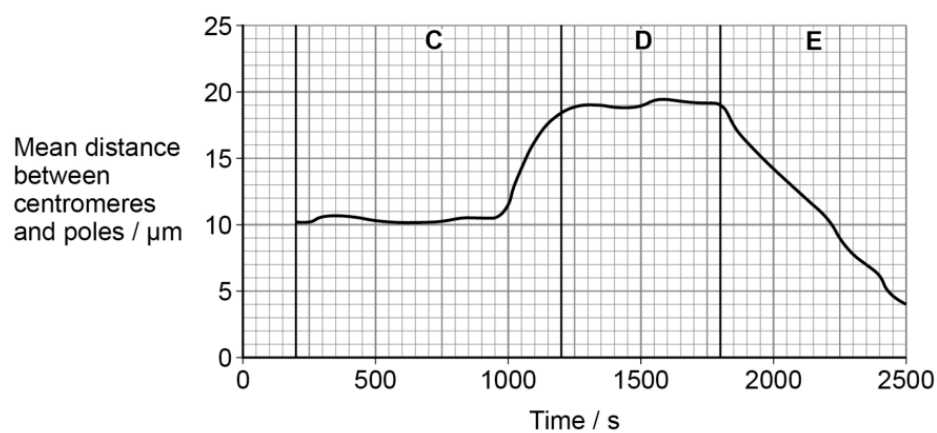
2.

1

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

7 marks

Figure 7



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

Give your answer in $\mu\text{m minute}^{-1}$ and to 3 decimal places.

[2 marks]

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 $\mu\text{m minute}^{-1}$ **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**

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— AQA 7402/1 Biology · June 2021 · Paper 1, Question 6

3.

A student prepared a stained squash of cells from the root tips of garlic to calculate a mitotic index. He:

9 marks

1. cut the end 5 mm from 10 garlic roots
2. placed the root tips into a Petri dish containing 5 cm³ of hydrochloric acid for 12 minutes
3. rinsed the root tips in distilled water
4. placed one of the root tips on a microscope slide and added toluidine blue stain
5. placed a coverslip onto the microscope slide, and gently pressed the coverslip downwards on the root tip
6. observed the root tip using an optical microscope.

1

Suggest why the student soaked the root tips in hydrochloric acid in step 2.

[2 marks]

2

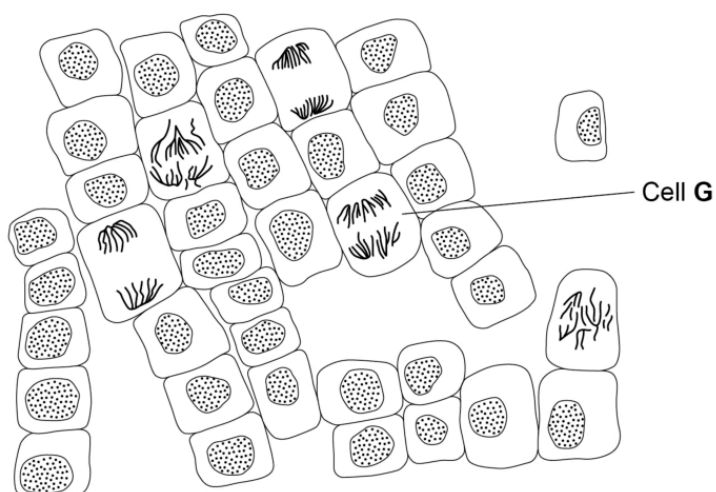
Pressing the coverslip downwards enabled the student to observe the stages of mitosis clearly.

Explain why.

[2 marks]

Figure 6 shows the student's drawing of one field of view.

Figure 6



3

Name the stage of mitosis shown in cell **G**. Explain the appearance of this cell.

[2 marks]

Stage of mitosis

Explanation

4

Use **Figure 6** to calculate a mitotic index for the cells in this field of view.

[1 mark]

Mitotic index

5

Other students in the class followed the same method, but calculated different mitotic indices.

Apart from student errors, suggest **two** explanations why.

[2 marks]

1

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2

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— AQA 7402/3 Biology · 2022 · Paper 3, Question 3

4.

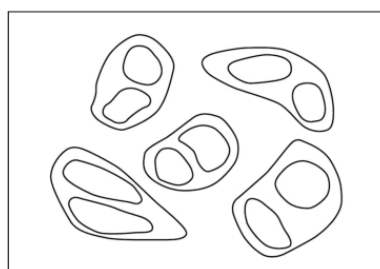
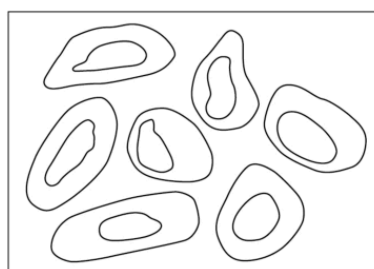
1

Scientists investigated a drug called MiTMAB as a treatment for cancer. MiTMAB inhibits cytokinesis.

10 marks

Figure 8 shows drawings of cancer cells seen with an optical microscope from a:

- sample treated with MiTMAB
- control sample.

Figure 8**A****B**

The cells in drawing **A** can be identified as those treated with MiTMAB.

Explain why.

[2 marks]

2

MiTMAB acts as a non-competitive inhibitor of an enzyme called dynamin.

Suggest how MiTMAB can cause dynamin to become inactive.

[3 marks]

When active, dynamin has **two** functions:

- it stimulates cytokinesis
- it inhibits cell death.

The scientists treated actively growing cultures of cancer cells with MiTMAB.

They incubated:

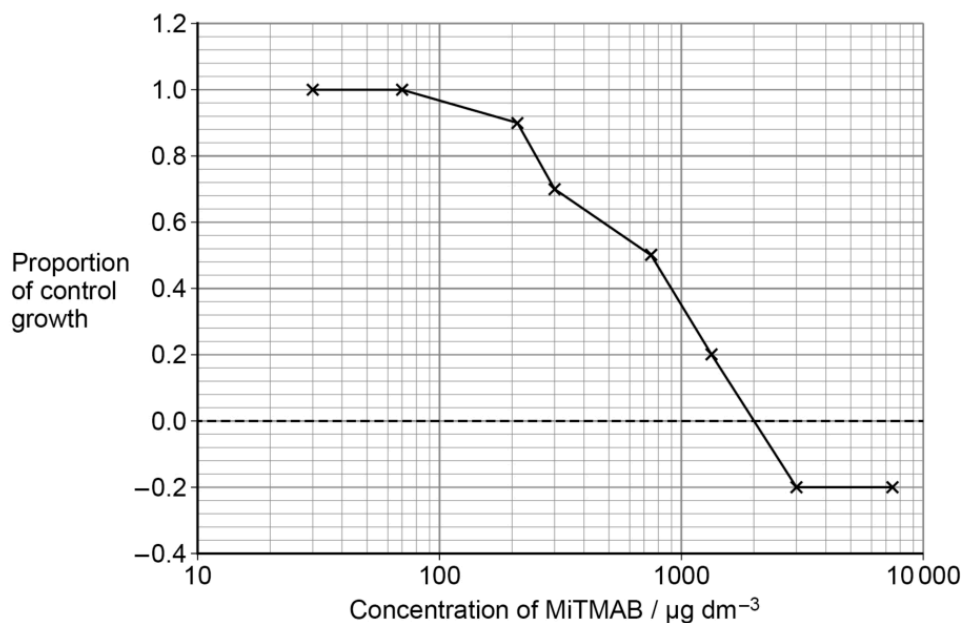
- one sample of 2500 cells without MiTMAB as a control
- eight samples, each with 2500 cells and a different concentration of MiTMAB.

After 72 hours, the scientists measured the number of cells in each sample.

Figure 9 shows the scientists' results.

A negative value for proportion of control growth means that fewer than 2500 cells were counted after 72 hours.

Figure 9



3

Use all the information given to explain the results shown in **Figure 9**.

[3 marks]

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4

0.01 dm³ of MiTMAB solution was added to the treated cells.

Calculate the increase in mass of MiTMAB (in µg) added to the cells to reduce the cell growth from equal to the control to 0.0 of the control.

Show your working.

[2 marks]

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Answer**µg**

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