

1.4 Cells: Division

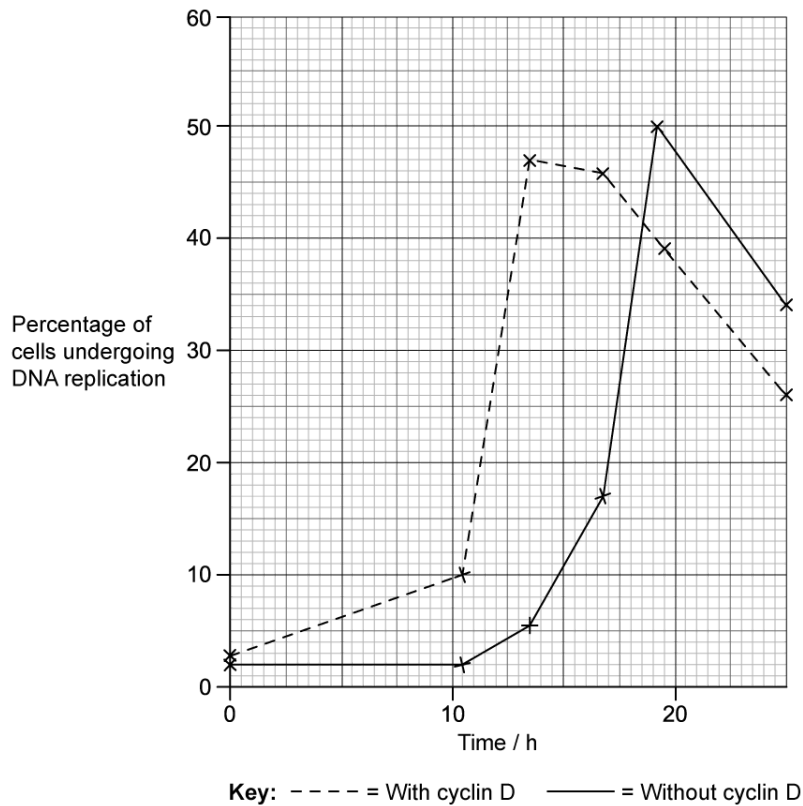
Question Paper

Course	DP IB Biology
Section	1. Cell Biology
Topic	1.4 Cells: Division
Difficulty	Hard

Time allowed: 10
Score: /5
Percentage: /100

Question 1

The graph shows some mice cells undergoing DNA replication.



Some cells contain a protein called cyclin D which stimulates the activation of DNA polymerase.

Which of the following statements applies to the action of cyclin D?

- A. Cyclin D is necessary for DNA replication to occur
- B. High cyclin D levels speeds up DNA replication which could lead to cancer
- C. Activation of DNA polymerase increases transcription of DNA which increases the rate of cell division
- D. Cyclin D increases the proportion of cells undergoing DNA replication

[1 mark]

Question 2

The table shows the number of chromosomes and the mass of DNA in different nuclei of a human body cell.

Which row in the table correctly identifies the number of chromosomes and mass of DNA found in the nucleus during the named stage of the cell cycle?

	Late interphase		Prophase		Telophase	
	Number of chromosomes	Mass of DNA / arbitrary units	Number of chromosomes	Mass of DNA / arbitrary units	Number of chromosomes	Mass of DNA / arbitrary units
A	92	50	46	50	23	25
B	46	50	46	50	46	25
C	46	50	46	25	46	25
D	92	50	46	25	23	12.5

[1 mark]

Question 3

A specific androgen receptor (AR) found in the cytoplasm of cells interacts with the sex hormone, testosterone.

A repeating nucleotide base sequence, CAG, found in the gene for AR has been associated with the risk of developing prostate cancer.

The table below shows the results of two statistical tests which found an association between the number of CAG repeats and the risk of developing prostate cancer.

Number of CAG repeats in AR gene	Probability (P) value
≤ 10	0.02
≥ 20	0.25

The null hypothesis was;

'There is no significant association between the number of CAG repeats and the risk of developing prostate cancer'

Identify the conclusion which can be drawn from the data in the table.

- A. With 20 or more CAG repeats, we can reject the null hypothesis
- B. Prostate cancer is more likely with 20 or more CAG repeats with more than a 5% probability that results are due to chance
- C. With 10 or fewer than 10 repeats the association is not-significant with less than a 5% probability that results are due to chance
- D. With 10 or fewer than 10 repeats the association is significant with less than a 5% probability that results are due to chance

[1 mark]

Question 4

In humans, cell division is regulated by several genes, one of which, p53, inhibits cell division at a particular checkpoint in the cell cycle through the following mechanism.

- p53 stimulates transcription of a gene to produce protein X
- Protein X combines with a cyclin-dependent kinase (CDK) protein
- The complex prevents the initiation of mitosis

A heritable mutation in the p53 gene produces a dominant allele which inhibits the normal function of p53.

Which of the following explains the potential result of inheriting a mutant version of the p53 gene.

- A. Increasing production of protein X results in a faster rate of cell division
- B. Uncontrolled cell division resulting from the formation of more CDK-protein X complexes
- C. Decreased synthesis of protein X resulting in uncontrolled cell division
- D. Decreased transcription of protein X resulting in programmed cell death

[1 mark]

Question 5

Some scientists were investigating mitosis in plant cells. They applied a chemical agent called colchicine, which interferes with tubulin proteins in the cytoplasm. An image of some chromosomes from a treated cell can be seen below.



How does treatment with colchicine prevent the progression of cell division in plant cells?

- A. Treatment with colchicine prevents cells from moving past interphase as chromosomes are decondensed
- B. Treatment with colchicine prevents cells from moving into prophase as spindle fibres have not formed
- C. Treatment with colchicine prevents cells from moving into anaphase as spindle fibres have not formed
- D. Treatment with colchicine prevents cells from moving past metaphase as chromosomes are decondensed

[1 mark]