



CHEMISTRY ONLINE
— **TUITION** —

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BIOLOGY

CELLS

Level & Board	AQA (A-LEVEL)
TOPIC:	CELLS & MITOSIS
PAPER TYPE:	QUESTION PAPER-1
TOTAL QUESTIONS	6
TOTAL MARKS	34

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Cell cycle and Mitosis 1

1.

(a) Explain how bacteria undergo binary fission. The diagram is given below.

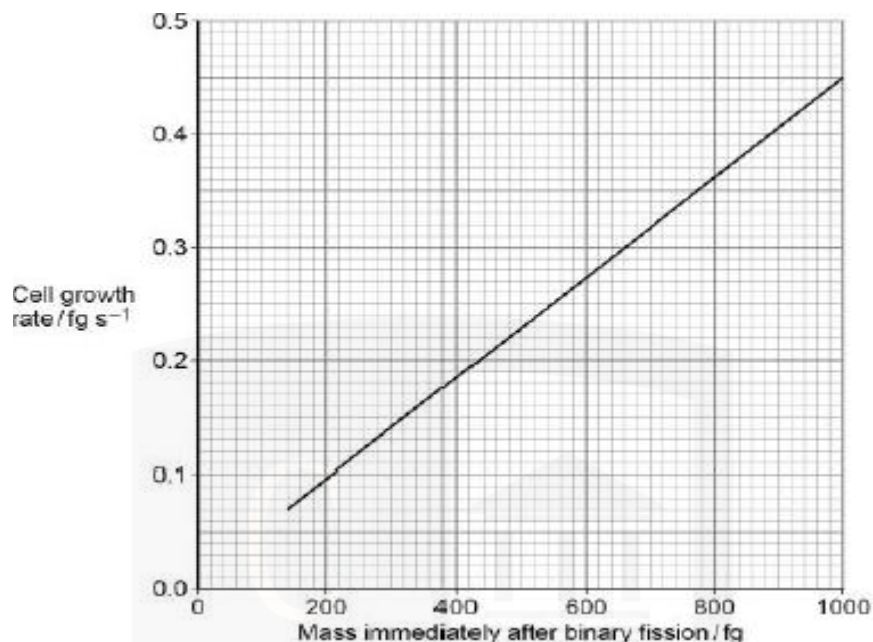
(3)



I am Sorry !!!!!

Bacillus subtilis cells grow at a rate that is proportionate to their mass right after binary fission.

The relationship is depicted in the graph below.



(b) Femtograms (fg) are a unit of measurement for the mass of the bacterial cells.

$$1 \text{ fg (femtogram)} = 1 \times 10^{-15} \text{ g}$$

Place a tick (\checkmark) in the box next to the number that is equal to 680 fg. **(1)**

0.000 000 000 0068 g

$6.8 \times 10^{-13} \text{ g}$

$6.8 \times 10^{-15} \text{ g}$

$6.8 \times 10^{-17} \text{ g}$

By monitoring the mass of a *B. subtilis* cell for five minutes, a scientist was able to calculate its growth rate.

The mass of the cell increased by 90 fg in those five minutes.

(c) Calculate the mass of this cell immediately after binary fission using this information and the graph above.

Display your work. (2)

Answer _____ fg

(d) Provide a suggestion and an explanation of how two environmental factors could be altered to speed up these cell's growth. (4)

Suggestion

1

Explanation

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Suggestion

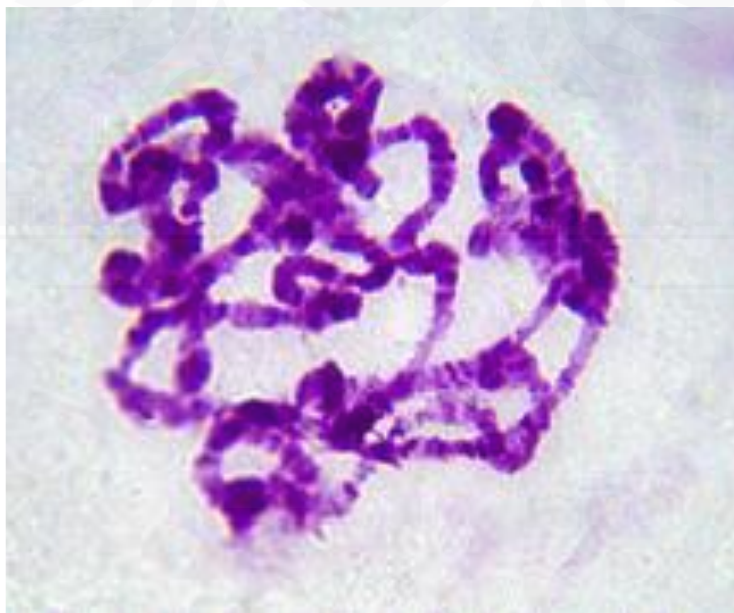
2

Explanation

2.

The topic of this inquiry is cell mitosis.

The genetic material is arranged in a cell during prophase, as seen in the image below.







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(a) Explain how the genetic material is arranged in the image above. (2)

(b) Four chromosomes make up each diploid body cell in an insect species.

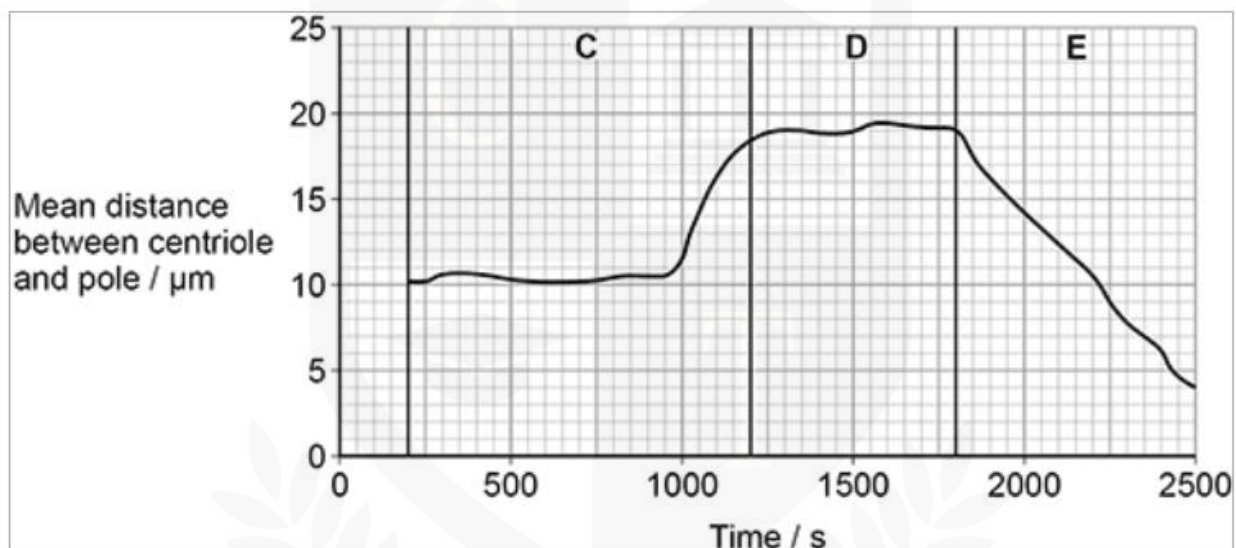
Check (✓) the box next to the diagram (A, B, C, or D) that shows how chromosomes appear in a cell during this species metaphase. (1)

A		<input type="checkbox"/>
B		<input type="checkbox"/>
C		<input type="checkbox"/>
D		<input type="checkbox"/>

(c) Identify the fixed location on a DNA molecule that a gene occupies. (1)

3.

(a) The average distance during mitosis between the centromeres and the poles or ends of the spindle is depicted in the figure below.



Determine how quickly the centromeres move during phase E.

Provide your response to three decimal places and in $\mu\text{m minute}^{-1}$. (2)

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

(b) Identify the three stages of mitosis represented by C, D, and E in the above figure.

Explain the function of the spindle fibers and the chromosomes' actions in each of these stages. **(5)**

C

D

E



4.

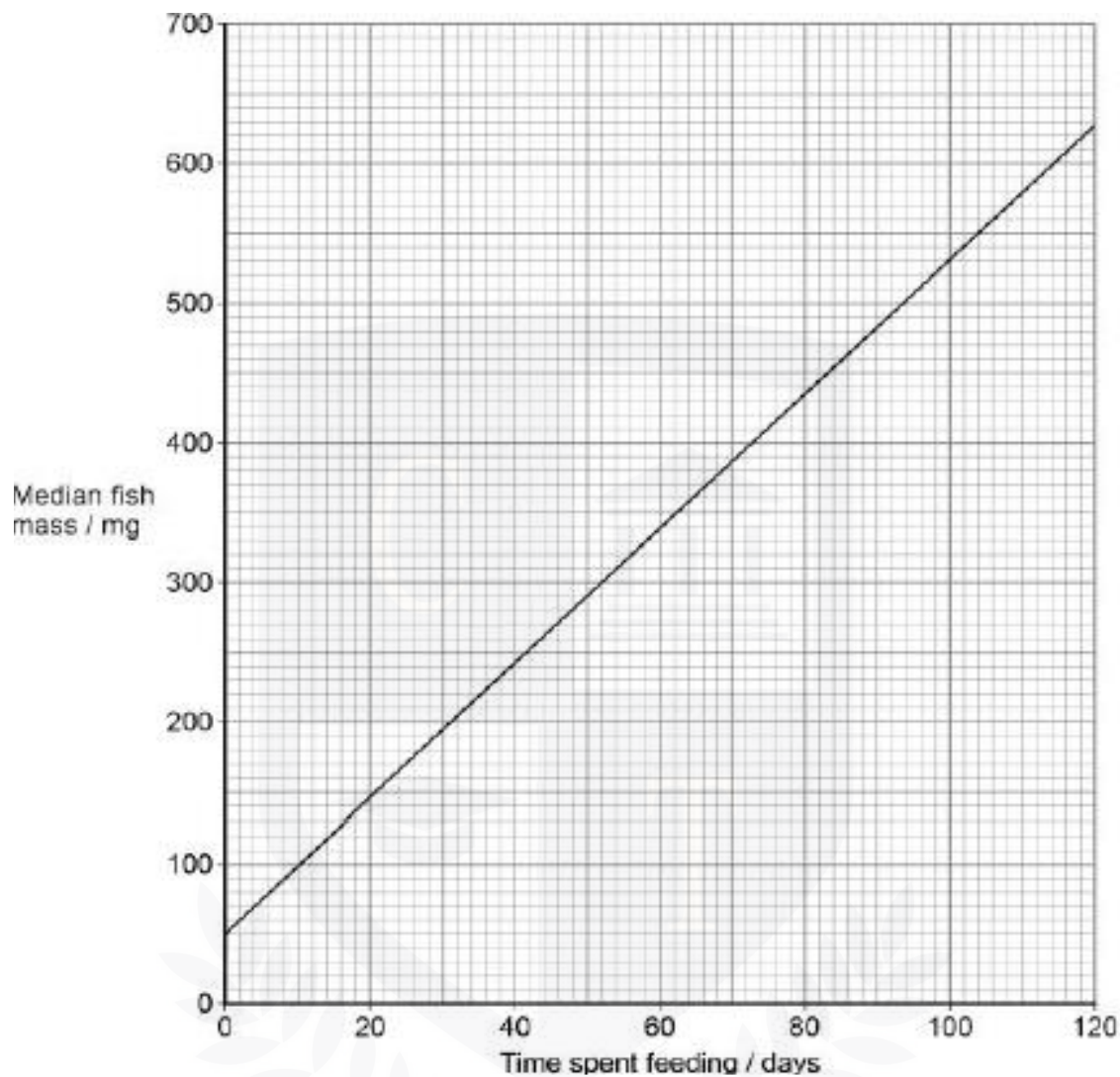
I am Sorry !!!!! Fish farms frequently produce trout, a particular kind of fish.



A scientist studied the growth of trout raised on farms. Periodically, she calculated the median mass of a sizable population of trout. The day the newly hatched fish started feeding was when she started measuring. The graph below displays the results she obtained.

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This equation is used to represent the best fit line on the graph.

$$\text{median fish mass} = (m \times \text{days feeding}) + 50$$

and m is the gradient of the best fit line.

(a) After feeding the fish for 195 days, find the median mass of the fish using the equation and the graph above.

Display your work. **(2)**

Answer _____ mg

(b) Each cell in a trout body has 80 chromosomes.

The mass of DNA in each nucleus and the number of chromosomes are displayed in the table below. The nuclei originate from a single trout. **(2)**

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Fill in the following table. **(2)**

Nucleus	Number of chromosomes	Mass of DNA / arbitrary units
At prophase of mitosis	80	
At telophase of mitosis		25
From an egg cell		

(c) Describe one genetically distinct feature of meiosis-produced trout eggs. **(1)**

Each cell in a trout body has 80 chromosomes.

Diploid egg cells are produced by treating female trout raised in farms.

(d) Indicate the number of chromosomes in the body cells of the progeny born to treated and untreated farmed trout. **(1)**

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Number of chromosomes _____

(e) Trout raised in farms have sterile progeny. Make a suggestion and justify it. **(2)**

5.

Go over the passage that follows.

Scientists examined the effects of a novel medication called ABZ on stomach tumor cells in lab experiments. They discovered that ABZ prevented spindle fiber formation, which halted mitosis. They also discovered that some healthy cells were impacted by ABZ.

The process of mitosis is controlled. The nucleus of a cell contains a protein called cyclin B. It controls when mitosis occurs during the cell cycle. Cyclin B concentration in the nucleus rises sharply to initiate mitosis and falls to terminate it. The researchers discovered that in stomach tumor cells, ABZ raised and preserved a high concentration of Cyclin B.

Apoptotic cell death is referred to as such. Bcl⁻² and Bax, two nuclear proteins, are involved in apoptosis regulation. One avoids apoptosis

Based on their findings, the researchers proposed that ABZ might be a useful treatment for stomach cancer.

To answer the questions, draw on the information in the passage as well as your own understanding.

(a) Explain why the cell cycle was stopped by preventing the formation of spindle fibers. **(2)**

(b) Even though ABZ affects some healthy cells, suggest and explain why it might be used as a cancer treatment. **(1)**

6.

Researchers studied the cell cycle in mouse heart cells obtained six days prior to birth, as well as four, fourteen, and twenty-one days postpartum.

Their results are shown in the table. Age 0 days = day of birth.

Age / days	Percentage of heart cells undergoing mitosis	Percentage of heart cells undergoing DNA replication
-6	13.9	8.5
4	8.5	2.6
14	1.6	0.2
21	0.6	0.0

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(a) Explain the information in the above table. (2)



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