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BIOLOGY

CELLS

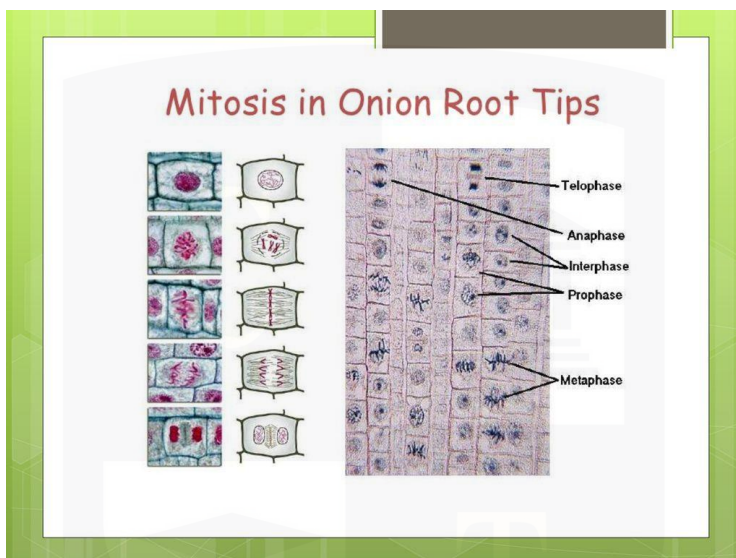
Level & Board	AQA (A-LEVEL)
TOPIC:	CELLS & MITOSIS
PAPER TYPE:	QUESTION PAPER-2
TOTAL QUESTIONS	6
TOTAL MARKS	38

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Cell Cycle and Mitosis 2

1.

(a) Using an optical microscope, the student prepared a stained squash of onion root tips and examined it.



He did the following steps to prepare the slide:

- cut the first 5 mm from the tip of an onion root and place it on a glass slide
- covered this tip with a drop of stain solution and a cover slip
- warmed the glass slide
- Press down firmly on the cover slip.

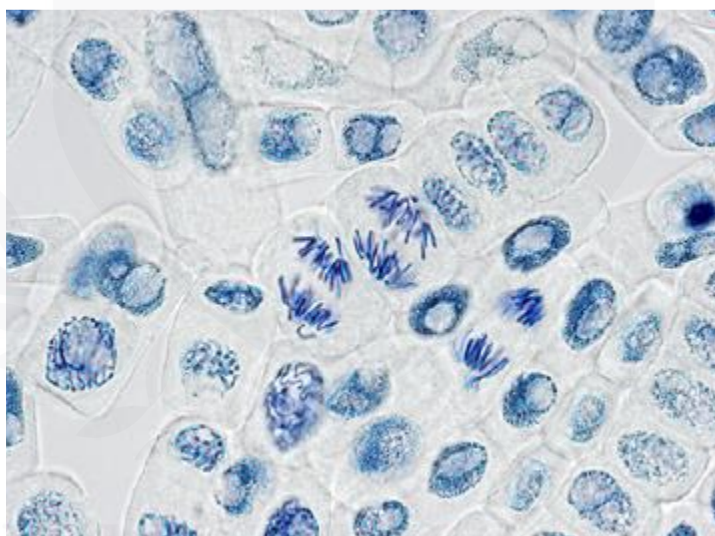
He counted and identified nuclei at various cell cycle stages. Justify the student's actions. **(2)**

1. Only the first 5 mm of an onion root tip was used.

2. firmly applied pressure to the cover slip.

The cells the student saw in one field of view are depicted in Figure 1. He determined how long these onion cells were in the anaphase of mitosis using this field of view.

Figure 1



(b) Researchers have discovered that onion cells spend an average of 105 minutes during the anaphase phase of mitosis. Additionally, they discovered that the onion root depicted in Figure 1 has a cell cycle that takes 1080 minutes.

In Figure 1, 32 entire cells are displayed.

Determine how long the onion root's cells are in anaphase using the information and Figure 1, and then compute the percentage difference between your result and the scientists' calculated mean duration.

Display your work. **(2)**

Answer = _____ %

(c) Mark (✓) the name of the cytoplasmic division that occurs during the cell cycle. **(1)**

A Binary fission

B Cytokinesis

C Phagocytosis

D Segregation

(d) Describe and clarify the steps the student should have taken to ensure the accuracy of the mitotic index he calculated for this root tip when counting cells. **(2)**

(e) A chemical that inhibits root growth was applied by a scientist to the growing tips of onion roots. He prepared a stained squash of these root tips after a day.

The chromosomes in a single cell seen in the squash of one of these root tips during anaphase are depicted in Figure 2. This cell, like other cells in anaphase in these root tips, was typical.

Figure 2



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Make suggestions about how the chemical prevents root growth based on all of this information. (3)

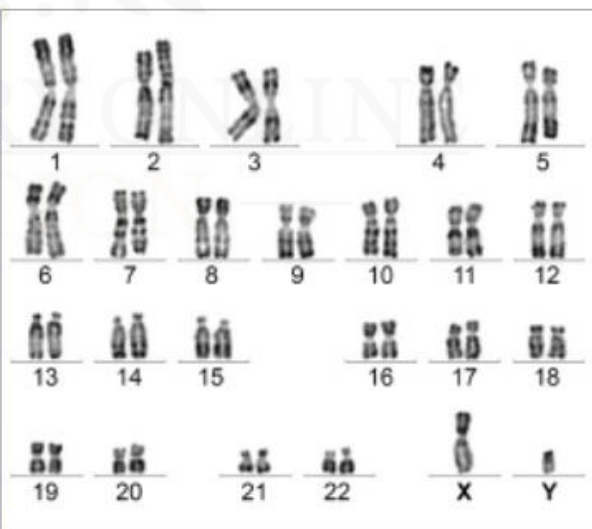
2.

Every chromosome found in a single human cell during mitosis is depicted in Figure 1. A scientist dyed and captured images of the chromosomes. The images of these chromosomes have been arranged in homologous pairs by the scientist in Figure 2.

Figure 1



Figure 2



(a) Cite two instances in Figure 1 supporting the hypothesis that this cell was going through mitosis. Give an explanation for your responses. **(2)**

(b) Mark (✓) the box corresponding to the name of the mitotic stage depicted in Figure 1. **(1)**

A Anaphase

B Interphase

C Prophase

D Telophase

(c) The scientist prepared the cells for observation by putting them in a solution with a water potential that was marginally higher (less negative) than the cytoplasm. Instead of causing the cells to explode, this caused the

chromosomes to spread apart, which lessened their overlap when viewed under an optical microscope.

Explain how the chromosomes were separated by this process. **(2)**

(d) The chromosomes appear striped because the dark stain applied to them binds more strongly to certain regions of the chromosomes than to others.

Provide an example of how the chromosome structure might vary along its length to cause the stain to bind more strongly in certain places. **(1)**

(e) The chromosomes are grouped in homologous pairs in Figure 2.

What is a homologous chromosomal pair? **(1)**

3.

(a) Identify the bacterial cell division process. **(1)**

The ability of various plant oils to destroy the bacteria *Listeria monocytogenes* was studied by a microbiologist. Using agar plates, she cultivated the bacteria. The bacteria were taken from a broth culture by her.

(b) Give an example of two aseptic methods she would have applied to the transfer of a broth culture sample to an agar plate.

Describe the significance of each. **(4)**

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4.

(a) Explain how chromosomes behave and look during mitosis. **(5)**

5.

A student looked into the process of mitosis in onion root tip tissue.

(a) On a glass slide, the student made a temporary mount of the onion tissue. She placed a cover slip over the tissue. The next directive was then given to her.

"Depress firmly on the cover slip; do not push it in a sideways direction."

Explain why she was given this instruction. **(2)**

One of the student observations of a cell in the onion tissue is depicted below.



(b) The pupil deduced that the cell in the preceding image was in the anaphase phase of the mitotic cycle.

Was she right? Explain your response with two points. **(2)**

1.

2.

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(c) The number of cells the student saw at each stage of mitosis was counted.

Just six of the 200 cells she counted were in the anaphase.

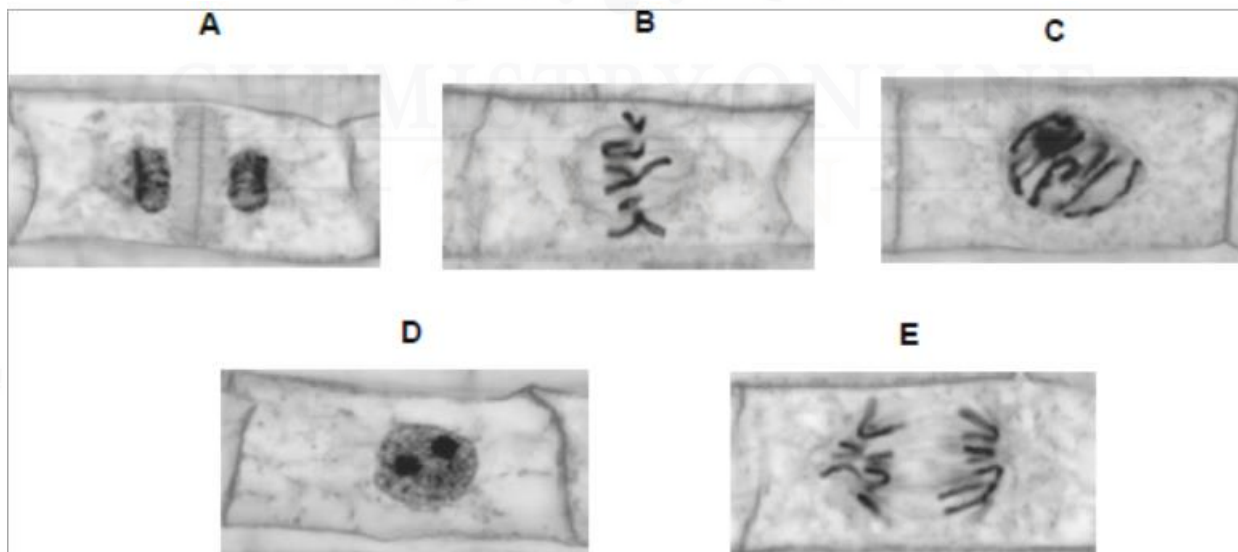
Onion root tissue takes sixteen hours to complete a cell cycle. Determine the duration of anaphase in these cells in minutes.

Display your work.

Answer = _____ minutes

6.

A few cells from the root tip of an onion are depicted in the figure below at various phases of the cell cycle.



(a) Arrange steps A through E in the proper sequence. Proceed to stage D first. **(1)**

D

The onion root tip was removed, stained, and placed on a microscope slide in order to create these images. On top, a cover slip was put. After firmly squashing the root tip, the sample was examined under an optical microscope.

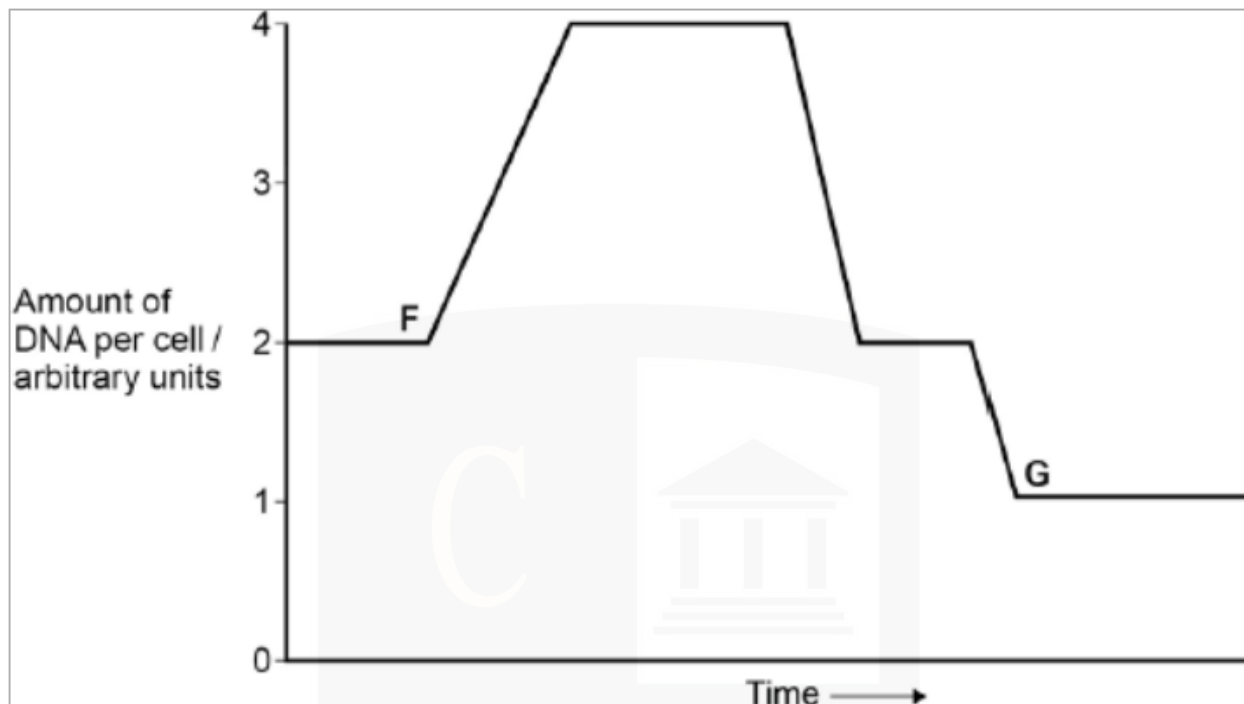
(b) Fill in the table below with one justification for why each of these actions was required. **(2)**

Step	Reason
Taking cells from the root tip	
Firmly squashing the root tip	

The diagram below illustrates how an animal DNA content varied during interphase and meiosis.

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(c) Describe how these variations in the amount of DNA per cell between F and G are caused by the behavior of chromosomes. (3)

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(d) When cell G is fertilized, what would happen to the amount of DNA in each cell? (1)



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- Founder & CEO of Chemistry Online Tuition Ltd.
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