Questions 1 & 2 refer to the following diagram of a chromosome.

1. Which pair of numbered regions belong to a single chromatid?
   A) 1 and 3  
   B) 1 and 4  
   C) 1 and 5  
   D) 3 and 4  
   E) 3 and 5  

2. Sister chromatids are indicated by the numbers
   A) 1 and 2  
   B) 1 and 3  
   C) 2 and 3  
   D) 3 and 5  
   E) 4 and 5
3. The purpose of the mitosis includes all of the following EXCEPT

A) reproduction in a single-celled amoeba
B) repair of tissue in an injury caused by a burn
C) replacement of cells removed by a skinned knee
D) lengthening the long bones of a child
E) formation of sperm by a frog

4. The correct order for the phases of the cell cycle is

A) M, G₂, S, G₁
B) G₁, M, S, G₂
C) G₁, S, G₂, M
D) M, S, G₂, G₁
E) G₂, S, M, G₁

5. Which of the following is a region of the cell that helps to organize the spindle?

A) Centriole
B) Centromere
C) Centrosome
D) Chromatid
E) Chromosome

6. Some chemotherapy interferes with the assembly of microtubules at the cellular level. The effectiveness of the treatment must be related to

A) condensation of chromatin
B) inhibition of DNA replication
C) inhibition of spindle formation
D) disassembly of the nuclear envelope
E) increase in the amount of cytoplasm
Directions: The group of questions below consists of five lettered answers followed by a list of numbered phrases or sentences. For each numbered phrase or sentence select the one answer that is most closely related to it and fill in the corresponding oval on the answer sheet. Each answer may be used once, more than once or not at all in each group.

Questions 7 - 9
Crystal used a microscope to view a variety of prepared slides containing different types of cells undergoing cell division. The results of her analysis are shown below.

<table>
<thead>
<tr>
<th>Slide Label</th>
<th>Type of Cell</th>
<th>Number of Chromosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>human sperm (n)</td>
<td>23</td>
</tr>
<tr>
<td>B</td>
<td>fruit fly (2n)</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>human cheek (2n)</td>
<td>46</td>
</tr>
<tr>
<td>D</td>
<td>grasshopper gland (2n)</td>
<td>24</td>
</tr>
<tr>
<td>E</td>
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</table>

7. Which slide contains cells that would have 12 chromosomes during anaphase?

8. All of the slides contain diploid cells except.

9. Which slide has cells that do not go through mitosis?

Questions 10-12 refer to the following diagrams of cells in various stages of division.

10. Shows a cleavage furrow

11. Shows daughter cells

12. Shows a cell where the DNA exists as chromatin
Questions 13 - 15 refer to the following mitotic structures.

13. A spindle fiber
14. A centromere
15. A centrosome
Directions: The suggested time is about 15 minutes for answering a free response biology question, which is worth 10 points. The parts within a question may not have equal weight. Answers must be in essay form. Outline form is NOT acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write.

Question 1 (10 pts)

Cells are reproduced through the process of mitosis. Discuss the process of mitosis as it would occur in a typical animal cell, such as a cheek cell by including the following in your discussion.

A. Identify the stages of mitosis and state the order in which they occur.

B. Describe what happens to the chromosomes during each stage of the process.
C. State the expected end result of mitosis.

D. Explain cytokinesis and its relationship to mitosis in an animal cell.
Ahmed and his lab partner are using a microscope to collect data on onion root tip cells. They observed cells in various stages of the cell cycle. Ahmed and his lab partner have surveyed nine fields of view, tallied the data and placed it in the table below.

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<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
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Ahmed and his partner have one more field of view to survey and it is shown below.

A. Enter the data from the 10th field of view into the data table above.
B. Explain to Ahmed the events that occur in a cell during interphase. In your explanation reference the names of the three stages of interphase and describe what is occurring in each.

C. Occasionally a fourth stage of interphase, G\textsubscript{0}, is found in certain types of cells. Identify a type of cell that remains in G\textsubscript{0} and justify your answer.
Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case and fill in the corresponding oval on the answer sheet.

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**Biology Multiple Choice**

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