**Part I: The Cell Cycle**

Use your resources at hand and the Explore Student Guide to outline what occurs within the cell during each stage of the cell cycle. Record this information in Table 1 below.

<table>
<thead>
<tr>
<th>Cell Cycle Phase</th>
<th>Diagram</th>
<th>Cell Activities</th>
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<tbody>
<tr>
<td>Interphase ((G_1, S, G_2))</td>
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<tr>
<td>Mitotic Phase ((M \text{ phase}))</td>
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<tr>
<td>Prophase</td>
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<td>Metaphase</td>
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<tr>
<td>Anaphase</td>
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<tr>
<td>Telophase</td>
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Part I: The Cell Cycle, continued

1. What type of microscope is best for viewing the phases of mitosis in a cell, and why?
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2. Explain what must happen before a cell is ready to begin the process of mitosis.
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3. Why is it important for the DNA in a cell to be completely replicated prior to cell division?
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4. What is the function of centromeres, and how are they important in nuclear division?
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5. At what phase of the cell cycle are chromatids considered complete chromosomes? Why is this important?
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6. During telophase, describe what distinguishes the process of cytokinesis. Why is this important?
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Part I: The Cell Cycle

Cell Cycle Slides
Examine the microscope slides and complete the Table 2 below.

<table>
<thead>
<tr>
<th>Slide</th>
<th>Cell Cycle Stage</th>
<th>Sketch and Magnification</th>
<th>Clues</th>
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<tbody>
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</table>
1. Describe two factors that are responsible for regulating the cell cycle. What is their role in the regulation process?

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2. Explain contact inhibition as it relates to the regulation of the cell cycle. Use examples from your reading to support your response.

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3. How might mutations affect the cell cycle? Be specific.

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4. What is the G₀ phase? In which cells does this occur?

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5. The cell cycle plays a key role in another cellular process. What is this process, and how might this process be triggered?

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Part III: Specialized Cells

Observe each of these cell types in the microscope. Record how the form and structures of each specialized cell allow it to perform its specialized function in an organism.

Red blood cell

Columnar epithelial cells

Smooth muscle cells
Part IV: DNA, RNA, and Differentiation

1. Show the path of gene expression in the space below. Use the following terms and create a simple graphic organizer: Protein Synthesis, DNA, Trait, RNA, Gene Expression

   [Blank space for graphic organizer]

2. What are genes, where are they found, and what do they do?
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3. In your own words, explain the connection between DNA, RNA, and proteins.
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4. How might the DNA-RNA-protein pathway affect cellular differentiation?
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5. How could a mutation in DNA affect an expressed trait of an individual organism?
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Part V: Disruptions in the Cell Cycle

1. What may be a bad consequence to the cell cycle if one of the regulatory signal fails?

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2. What is a tumor? Describe the difference between a benign and a malignant tumor.

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3. Explain the role that certain environmental factors may have in the process of unregulated cell division. Provide an example to support your response.

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4. What is cancer?

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5. What processes may trigger the development of a cancer cell?

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6. What is oncogenesis?

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7. Explain the ways in which cells from a tumor may spread to other parts of the body.

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Reflections and Conclusions

1. You learned a little about the stem cells found in animals in your reading. How do these types of cell differentiate, and then explain, in your own words, why is it important for cells to be specialized?

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2. Use what you have learned to answer the following question. If you fell and cut your knee, what would happen if the cells in the injured area could not undergo the cell cycle? Be specific.

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3. Identify the factors responsible for regulating cell differentiation. At what point do these factors come into play during the cell cycle, and how do they affect both the cell cycle and cellular differentiation?

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4. Using all of the following terms, develop a graphic organizer based on what you have learned in this Explore. Use another sheet of paper if needed.

Terms: anaphase, centromere, chromatid, cytokinesis, daughter cells, differentiation, DNA, somatic cell, function, interphase, metaphase, microtubules, prophase, RNA, specialization, structure, telophase, protein, specialized cells, cancer, gene expression, oncogenesis, environmental factors, tumor, protein, protein synthesis.