The Cell Cycle - Mitosis

Grade Level or Special Area: Seventh Grade Science
Written by: Patricia Baechler, Academy of Charter Schools, Denver, Colorado
Length of Unit: Seven lessons (50 minutes each)

I. ABSTRACT

Cell division is the processes of growth and reproduction. Through lecture, writing, and activities students will learn the cell cycle with an emphasis on mitosis. Students will complete a cell cycle booklet to summarize the sequential stages of cell development.

II. OVERVIEW

A. Concept Objectives
   1. Understand that stability is related to the idea that nature is predictable.
   2. Understand that cyclical changes are common to living systems.

B. Content from the *Core Knowledge Sequence*
   1. Cell division, the basic process for growth and reproduction
      a. Mitosis (growth and asexual reproduction)
      b. Asexual reproduction: mitosis; diploid cells (as in amoeba)

C. Skill Objectives
   1. Students will describe each phase of the cell cycle.
   2. Students will define key terms.
   3. Students will match events to the correct phase of the cell cycle.
   4. Students will explain asexual reproduction.
   5. Students will list phases of the cell cycle in order.
   6. Students will summarize the cell cycle in one paragraph.

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. Miller, Kenneth R., & Levine, Joseph *Biology*. Upper Saddle River, New Jersey: Prentice Hall, 2002. 0-13-050742-3
   2. DiSpezio, M. A., Linner-Luebe, Marilyn, Lisowski, Marylin, Skoog, Gerald, & Sparks, Bobbie *Science Insights: Exploring Living Things*. Addison-Wesley, 1994. 0-201-25729-7

B. For Students
   1. Review from grade 5, Cell structures and processes.
   2. Students will need to know how to summarize a scientific topic

IV. RESOURCES

A. Miller, Kenneth R., & Levine, Joseph *Biology*. Upper Saddle River, New Jersey: Prentice Hall, 2002. 0-13-050742-3

B. DiSpezio, M. A., Linner-Luebe, Marilyn, Lisowski, Marylin, Skoog, Gerald, & Sparks, Bobbie. *Science Insights: Exploring Living Things*. Addison-Wesley, 1994. 0-201-25729-7

V. LESSONS

Lesson One: Introduction to the Cell Cycle

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that stability is related to the idea that nature is predictable.
      b. Understand that cyclical changes are common to living systems.

2. Lesson Content
    a. Mitosis (growth and asexual reproduction)
3. Skill Objective(s)
    a. Students will list phases of the cell cycle in order.
    b. Students will define key terms.

B. *Materials*
1. Copy of Appendix A1 for teacher reference
2. Copies of Appendix B for each student
3. Transparency of Appendix C

C. *Key Vocabulary*
1. Cell Cycle: period from the beginning of one cell division to the beginning of the next
2. Interphase: the time period between cell division, cell spends most of its time during this phase of the cell cycle
3. Prophase: the first and longest phase of mitosis
4. Metaphase: the second and shortest phase of mitosis
5. Anaphase: the third phase of mitosis
6. Telophase: the fourth and last phase of mitosis

D. *Procedures/Activities*
1. Have one copy of Appendix B for each student. Ask each student to fill out the top portion to pre-assess if they know the order of the phases of the cell cycle. (There can be some variation depending on which phase they start with.)
2. Ask students to share their answers with the class.
3. Using Appendix C (overhead) correct any mistakes they have and ask them to fill in the bottom portion of Appendix B. While going through the phases, define each one (use Appendix A1) and have them write the definitions at the bottom of Appendix B.
4. Have students answer question on page 2 of Appendix B.

E. *Assessment/Evaluation*
1. Appendix B – pre-assess their knowledge of the phases of the cell cycle

Lesson Two: Interphase

A. *Daily Objectives*
1. Concept Objective(s)
    a. Understand that cyclical changes are common to living systems.
2. Lesson Content
    a. Mitosis (growth and asexual reproduction)
3. Skill Objective(s)
    a. Students will describe each phase of the cell cycle.
    b. Students will define key terms.

B. *Materials*
1. Transparency of Appendix A1
2. Transparency of Appendix A2
3. Copies of Appendix E1 for each student
4. Copies of Appendix E2 for each student
5. Pens, colored pencils, or markers

C. *Key Vocabulary*
1. Replication: copying of chromosomes

D. *Procedures/Activities*
1. Ask students to head a piece of notebook paper with the title of "The Cell Cycle." Just below this they should put the heading of "Interphase."

2. Using Appendix A2 (transparency), have students copy the picture of the cell in interphase onto their paper. Make sure the bottom half is covered, allowing them to focus on the picture.
3. Using Appendices A1 and A2, explain what occurs in interphase and any new key vocabulary. Uncover each piece as you explain it. Tell students to copy the information from the overhead to their notes.
4. Ask students to repeat back the information they just learned.
5. Hand each student a copy of Appendix E1 (rubric). Explain that they will be creating a booklet about the cell cycle and review the rubric with them.
6. Using Appendix E2, ask students to create a picture of a cell with four chromosomes in interphase using the pens, colored pencils, or markers and write the events that occur in interphase in the spaces below (highlighting key vocabulary and defining below).
7. Ask student to answer questions on page 2 when finished with page 1.

E. *Assessment/Evaluation*
1. Appendix E2 - accuracy of drawing of interphase, events accurately written down with key words highlighted and defined.
2. Questions (Appendix E2, page 2) are answered correctly.

Lesson Three: Prophase

A. *Daily Objectives*
1. Concept Objective(s)
   a. Understand that cyclical changes are common to living systems.
2. Lesson Content
   a. Mitosis (growth and asexual reproduction)
3. Skill Objective(s)
   a. Students will describe each phase of the cell cycle.
   b. Students will define key terms.

B. *Materials*
1. Transparency of Appendix A1
2. Transparency of Appendix A3
3. Copies of Appendix E3 for each student
4. Pens, colored pencils, or markers

C. *Key Vocabulary*
1. Centrioles: organelles that organize the spindle and pull chromosomes apart
2. Poles: the opposite sides of the cell
3. Spindle: fibers that are used to pull chromosomes apart, organized by the centrioles

D. *Procedures/Activities*
1. Ask students to get out previous lessons' notes and add the heading of prophase below their previous work. Using Appendix A3 (transparency) have students copy the picture of the cell in prophase onto their paper. Make sure the bottom half is covered, allowing them to focus on the picture.
2. Using Appendices A1 and A3, explain what occurs in prophase and any new key vocabulary. Uncover each piece as you explain it. Tell students to copy the information from the overhead to their notes.
3. Ask students to repeat back the information they just learned.
4. Using Appendix E3, ask students to create a picture of a cell with four chromosomes in prophase using the supply of craft materials and write the events that occur in prophase in the spaces below (highlighting key vocabulary and defining below).

5. Ask student to answer questions on page 2 when finished with page 1.

E. *Assessment/Evaluation*
   1. Appendix E3 - Accuracy of drawing of prophase, events accurately written down with key words highlighted and defined.
   2. Questions (Appendix E3, page 2) are answered correctly.

Lesson Four: Metaphase/Anaphase

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that cyclical changes are common to living systems.
   2. Lesson Content
      a. Mitosis (growth and asexual reproduction)
   3. Skill Objective(s)
      a. Students will list phases of the cell cycle in order.
      b. Students will define key terms.

B. *Materials*
   1. Transparency of Appendix A1
   2. Transparency of Appendix A4
   3. Transparency of Appendix A5
   4. Copies of Appendix E4 for each student
   5. Copies of Appendix E5 for each student
   6. Pens, colored pencils, or markers

C. *Key Vocabulary*
   1. Centromeres – the point of attachment between copies of chromosomes
   2. Chromatids – the individual copies of a chromosome

D. *Procedures/Activities*
   1. Ask students to get out previous lessons' notes and add the heading of metaphase below their previous work. Using Appendix A4 (transparency) have students copy the picture of the cell in metaphase onto their paper. Make sure the bottom half is covered, allowing them to focus on the picture.
   2. Using Appendices A1 and A4, explain what occurs in metaphase and any new key vocabulary. Uncover each piece as you explain it. Tell students to copy the information from the overhead to their notes.
   3. Ask students to add the heading of anaphase phase below their previous work. Using Appendix A5 (transparency) have students copy the picture of the cell in anaphase onto their paper. Make sure the bottom half is covered, allowing them to focus on the picture.
   4. Using Appendices A1 and A5, explain what occurs in anaphase and any new key vocabulary. Uncover each piece as you explain it. Tell students to copy the information from the overhead to their notes.
   5. Using Appendices E4 and E5, Ask students to create a picture of a cell with four chromosomes in metaphase and anaphase using the pens, colored pencils, or markers and write the events that occur in each phase in the spaces below their pictures (highlighting key vocabulary and defining below).
   6. Ask student to answer questions on page 2 when finished with page 1.

E. *Assessment/Evaluation*
   1. Appendix E4 and E5 - accuracy of drawing of metaphase and anaphase, events accurately written down with key words highlighted and defined.
   2. Questions (Appendices E4, page 2 and E5, page 2) are answered correctly.

Lesson Five: Telophase

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that cyclical changes are common to living systems.
   2. Lesson Content
      a. Mitosis (growth and asexual reproduction)
   3. Skill Objective(s)
      a. Students will describe each phase of the cell cycle.
      b. Students will define key terms.

B. *Materials*
   1. Transparency of Appendix A1
   2. Transparency of Appendix A6
   3. Copies of Appendix E6 for each student
   4. Pens, colored pencils, or markers

C. *Key Vocabulary*
   None

D. *Procedures/Activities*
   1. Ask students to get out previous lessons' notes and add the heading of telophase below their previous work. Using Appendix A6 (transparency) have students copy the picture of the cell in prophase onto their paper. Make sure the bottom half is covered, allowing them to focus on the picture.
   2. Using Appendices A1 and A6, explain what occurs in prophase and any new key vocabulary. Uncover each piece as you explain it. Tell students to copy the information from the overhead to their notes.
   3. Ask students to repeat back the information they just learned.
   4. Using Appendix E6, ask students to create a picture of a cell with four chromosomes in telophase using the pens, colored pencils, or markers and write the events that occur in prophase in the spaces below (highlighting key vocabulary and defining below).
   5. Ask student to answer questions on page 2 when finished with page 1.

E. *Assessment/Evaluation*
   1. Appendix E6 - Accuracy of drawing of prophase, events accurately written down with key words highlighted and defined.
   2. Questions (Appendix E6, page 2) are answered correctly.

Lesson Six: When Does Mitosis Occur?

A. *Daily Objectives*
   1. Concept Objective(s)
      a. Understand that cyclical changes are common to living systems.
   2. Lesson Content
      a. Mitosis (growth and asexual reproduction)
   3. Skill Objective(s)
      a. Students will describe each phase of the cell cycle.
      b. Students will summarize the cell cycle in one paragraph.
      c. Students will define key terms.

B. *Materials*
   1. Slides (Fish blastula, Root tip, etc.)
   2. Microscopes
   3. Transparency of Appendix A1
   4. Copies of Appendix E7 for each student
   5. Copies of Appendix E8 for each student

C. *Key Vocabulary*
None

D. *Procedures/Activities*
1. Discuss the occurrence of mitosis is areas of the body (use information in Appendix A1). You might want to ask students if mitosis occurs at the same rate for all types of cells.
2. Use slides and microscopes set up stations for students to view cells in different stages of mitosis. If equipment is unavailable, you can use overheads of different cells in mitosis, these can be found in a variety of sources (books, Internet, etc.)
3. Discuss the difference between animal cells and plant cells undergoing mitosis (use Appendix A1).
4. Ask students to write a one-paragraph summary of mitosis (rough draft) using their own paper. Give each student a copy of Appendix E7 and ask him or her to use it for there final draft of his or her summary.
5. Give each student a copy of Appendix E8 and ask him or her to create a picture that represents mitosis as a cover page for his or her entire booklet.

E. *Assessment/Evaluation*
1. Summary of mitosis

Lesson Seven: Asexual Reproduction

A. *Daily Objectives*
1. Concept Objective(s)
   a. Understand that stability is related to the idea that nature is predictable.
   b. Understand that cyclical changes are common to living systems.
2. Lesson Content
   a. Mitosis (growth and asexual reproduction)
   b. Asexual reproduction: mitosis; diploid cells (as in amoeba)
3. Skill Objective(s)
   a. Students will match events to the correct phase of the cell cycle.
   b. Students will explain asexual reproduction.
   c. Students will define key terms.

B. *Materials*
1. Transparency of Appendix A1
2. Slides (Protists in cell division)
3. Microscopes

C. *Key Vocabulary*
1. Asexual reproduction - one parent produces offspring
2. Diploid Cell – a cell with two sets of chromosomes

D. *Procedures/Activities*
1. Use slides and microscopes of various protists in cell division. If equipment is not available, transparencies can be made using a variety of resources (books, Internet, etc.)
2. Explain to students that the slides show organisms during asexual reproduction (use Appendix A1). Define the term and explain that some organisms use only asexual reproduction. Define the term Diploid Cell and explain that almost all of their cells are diploid cells and that the organisms they see in the slides are diploid cells.
3. Ask students to finish their booklet.
4. When they are done, have students answer questions in Appendix F.

E. *Assessment/Evaluation*
1. Question answered correctly (Appendix F)

2. Completed cell cycle booklet.

VI. CULMINATING ACTIVITY

A. Students will produce a booklet about the cell cycle, which will include pictures, a list of events that occurs in each phase and a one-paragraph summary of mitosis.

VII. HANDOUTS/WORKSHEETS

A. Appendix A1: Teachers Notes
B. Appendix A2: Interphase Transparency
C. Appendix A3: Prophase Transparency
D. Appendix A4: Metaphase Transparency
E. Appendix A5: Anaphase Transparency
F. Appendix A6: Telophase Transparency
G. Appendix B: Phases of Mitosis
H. Appendix C: Phases of Mitosis: Transparency
I. Appendix E1: Cell Cycle Booklet - Rubric
J. Appendix E2: Cell Cycle Booklet – Interphase
K. Appendix E3: Cell Cycle Booklet – Prophase
L. Appendix E4: Cell Cycle Booklet – Metaphase
M. Appendix E5: Cell Cycle Booklet – Anaphase
N. Appendix E6: Cell Cycle Booklet – Telophase
O. Appendix E7: Cell Cycle Booklet – Summary page
P. Appendix E8: Cell Cycle Booklet – Cover
Q. Appendix F: Questions

VIII. BIBLIOGRAPHY

A. Miller, Kenneth R., & Levine, Joseph *Biology*. Upper Saddle River, New Jersey: Prentice Hall, 2002. 0-13-050742-3
B. DiSpezio, M. A., Linner-Luebe, Marilyn, Lisowski, Marylin, Skoog, Gerald, & Sparks, Bobbie Science *Insights: Exploring Living Things*. Addison-Wesley, 1994. 0-201-25729-7

Teachers Notes (Highlighted terms are key vocabulary)

I. Introduction to mitosis (Lesson 1) Use Appendix B2 (Transparency)
   A. Cell cycle – period from the beginning of one cell division to the beginning of the next
      1. Interphase - the phase between cell divisions, the cell spends most of its time during this phase
      2. M phase (mitosis) – Cell division – chromosomes become visible
         a. Prophase – The first and longest phase of mitosis
         b. Metaphase – The second and shortest phase of mitosis
         c. Anaphase – The third phase of mitosis
         d. Telophase - The fourth and last phase of mitosis

II. Interphase (Lesson Two) Use Appendix A2
Ask students to state the definition of Interphase. Explain that it is divided into three sections and explain each. Point out the key vocabulary term and its definition (Highlighted)
   A. G1 – Growing, producing organelles, proteins, and cytoplasm. Increasing in size.
   B. S – Replication of DNA
   C. G2 – Organelles and molecules needed for cell division

Replication: Chromosomes are copied

III. Prophase (Lesson Three)
Explain each event that occurs during prophase. Point out key vocabulary and define.
   A. Chromosomes coil
   B. Nucleolus disappears
   C. Nuclear membrane disappears
   D. Centrioles move to opposite poles
   E. Spindle forms

Poles: Opposite ends of the cell
Spindle: Fibers that pull the chromosomes apart, organized by the centrioles

IV. Metaphase (Lesson Four)
- A. Chromosomes line up at the center of the cell (called the metaphase plate)

V. Anaphase (Lesson Four)
- A. Centromeres split
- B. Chromatids are pulled to opposite poles of the cell

Centromeres: Attachment point between the chromatids.
Chromatids: The copies of a chromosome

VI. Telophase (Lesson Five)
- A. Chromosomes uncoil
- B. Nuclear membrane reappears
- C. Nucleolus reappears
- D. Spindle breaks down
- E. Cytokinesis occurs – Cytokinesis does not have to occur for mitosis to be complete.

Cytokinesis: The division of cytoplasm

VII. When does mitosis occur? (Lesson Six)
- A. Not all cells go through mitosis after you are born. Neurons (brain cells, nerve cells) do not go through mitosis after you are developed. Two exceptions – Olfactory nerve cells (sense of smell) and some cells associated with memory (hippocampus)
- B. Skin cells divide more frequently and faster than some other cells
- C. Plants go through mitosis like animal cells, with two differences: No centrioles, and they create a cell plate (completing the cell wall between the two new cells) to finish Cytokinesis.
- D. Uncontrolled cell division can create tumors, which can be cancerous.

VII. Asexual reproduction (Lesson Seven)
- A. Asexual reproduction: Production of offspring from one parent.
- B. Diploid Cell: Cells with two sets of chromosomes.
  1. Some organisms exist with only one set of chromosomes (certain insects). You can use this to introduce the term Haploid cell if you choose.

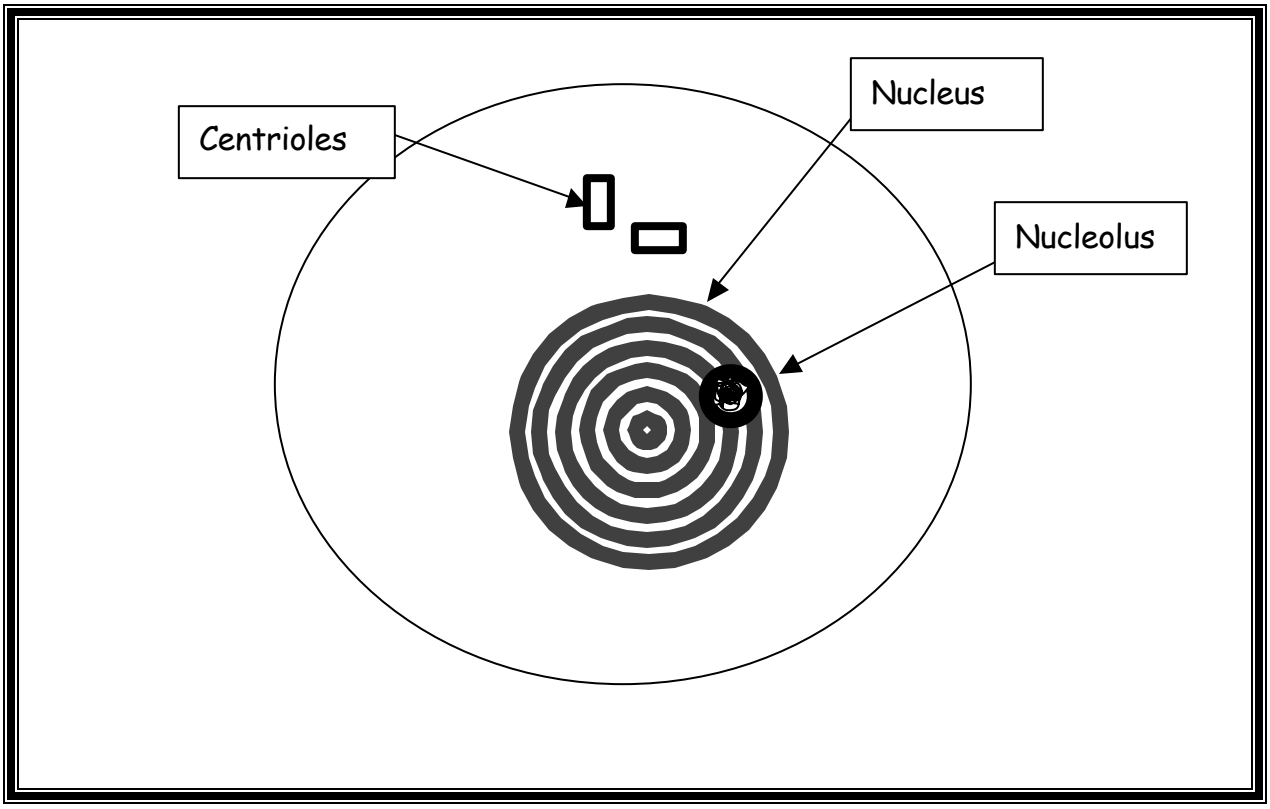
2. Many plants exist with more than two sets of chromosomes. This is called Polyploidy.

C. Single cell organisms, sponges, sea stars, some amphibian and reptiles are all examples of organisms that use asexual reproduction. In the more complex organisms it is often given the name of Parthenogenesis (reproduction using only one parent (you could mention that in the movie Godzilla, the newer one, that they used this idea.)

Appendix A2

The Cell Cycle

Interphase



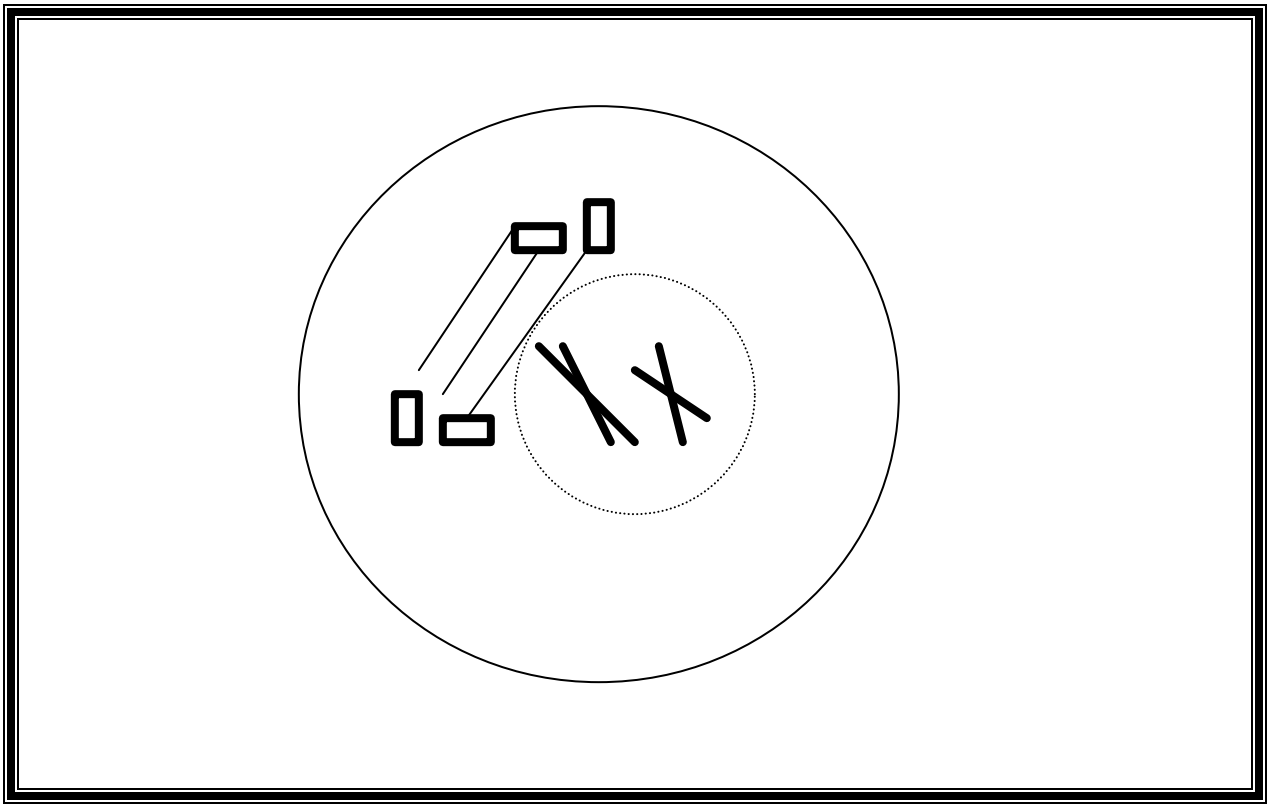
G1 – Growth, production of organelles, cytoplasm, and proteins.
S – Replication of DNA
G2 - Some growth, mostly of organelles needed for mitosis

Key Term:
Replication: Creating copies of chromosomes

Appendix A3

The Cell Cycle

PROphase



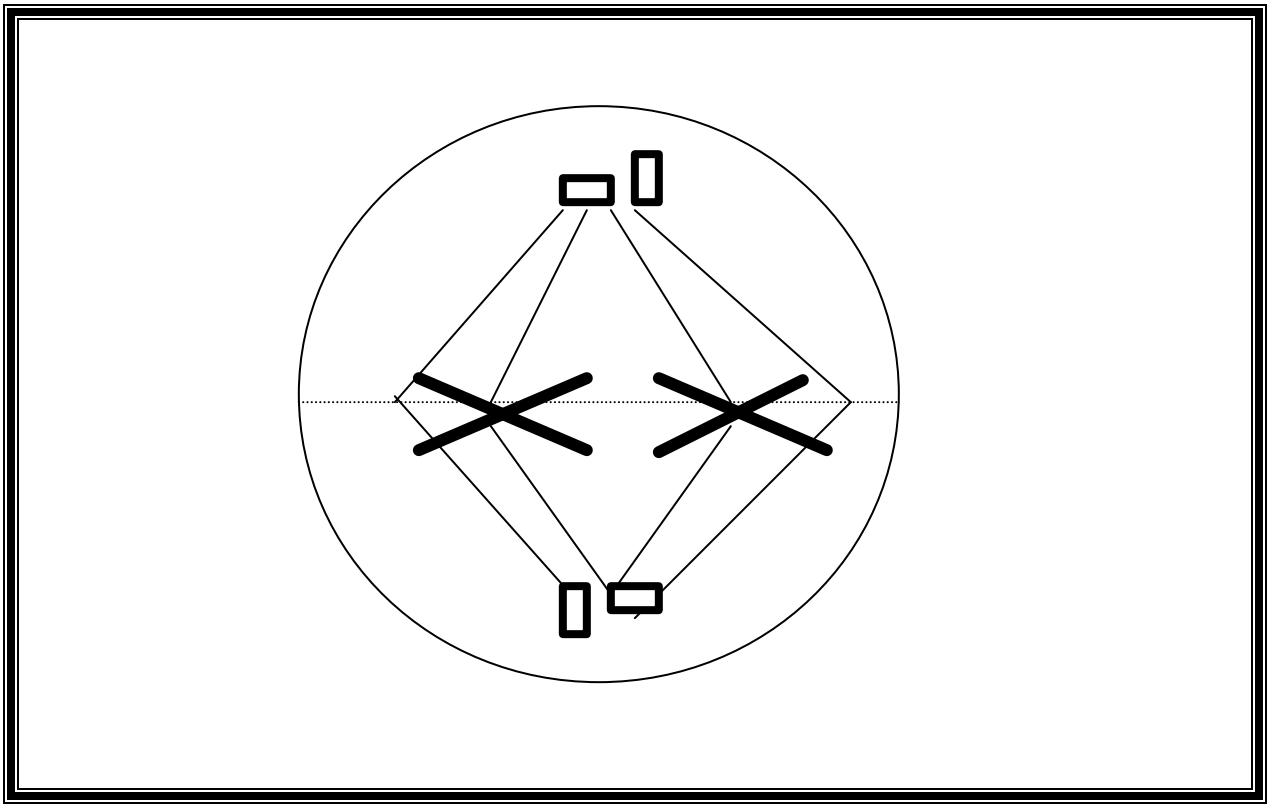
1. Chromosomes coil.
2. Nucleolus disappears.
3. Nuclear membrane disappears.
4. Centrioles move to opposite poles.
5. Spindle forms.

Key Term(s):
Poles: Opposite ends of the cell.
Spindle: Fibers that help pull the chromosomes apart.

Appendix A4

The Cell Cycle

METAphase

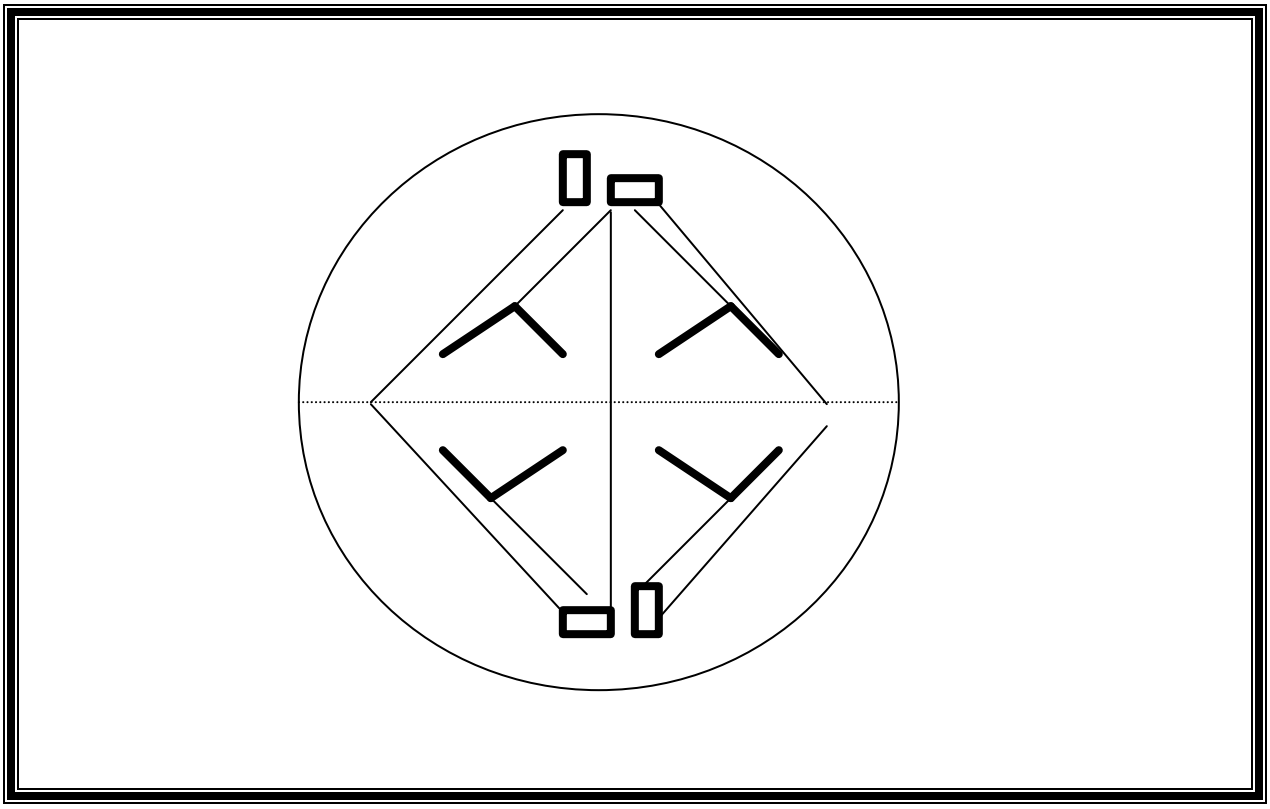


1. Chromosomes line up at the center of the cell.

Appendix A5

The Cell Cycle

ANAphase



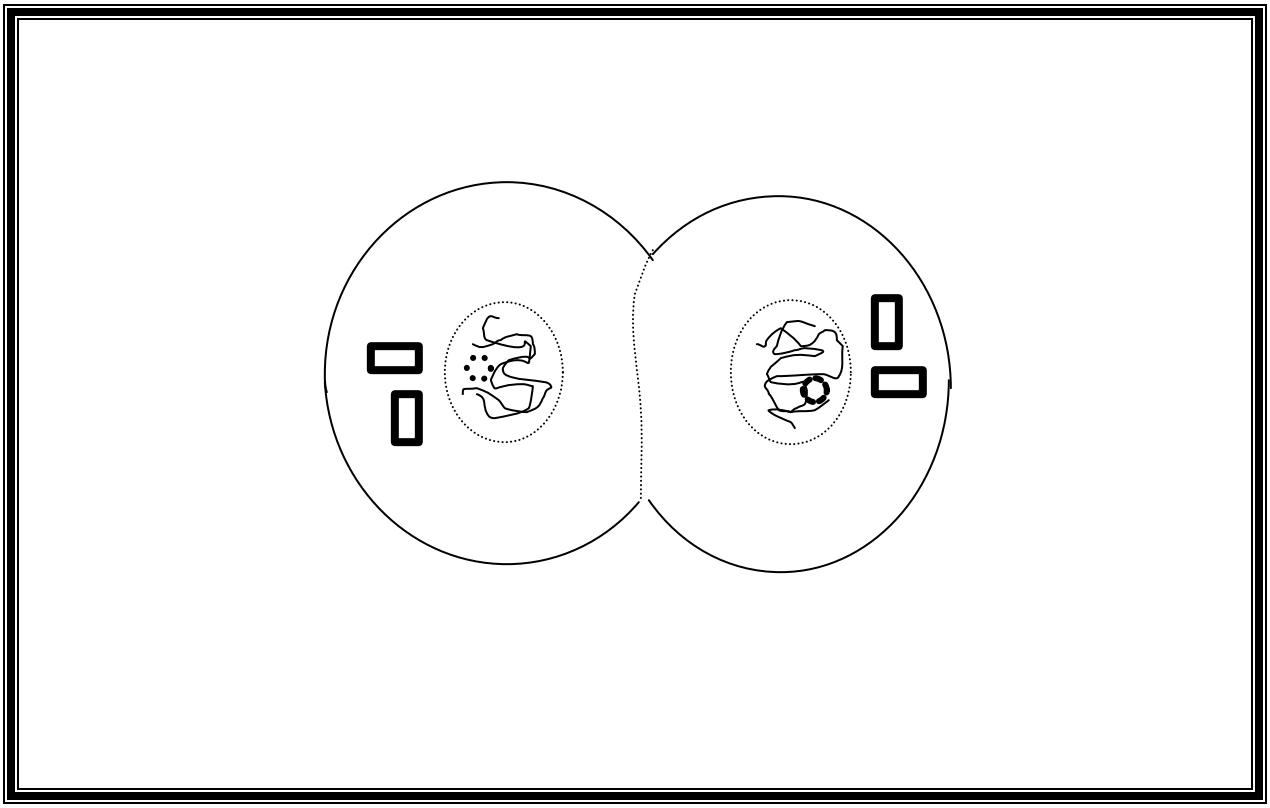
1. Centromeres split.
2. Chromatids are pulled to opposite poles.

Key Term(s):
Centromeres: the attachment point of the two chromatids.
Chromatids: the copies of the chromosomes.

Appendix A6

The Cell Cycle

Telophase

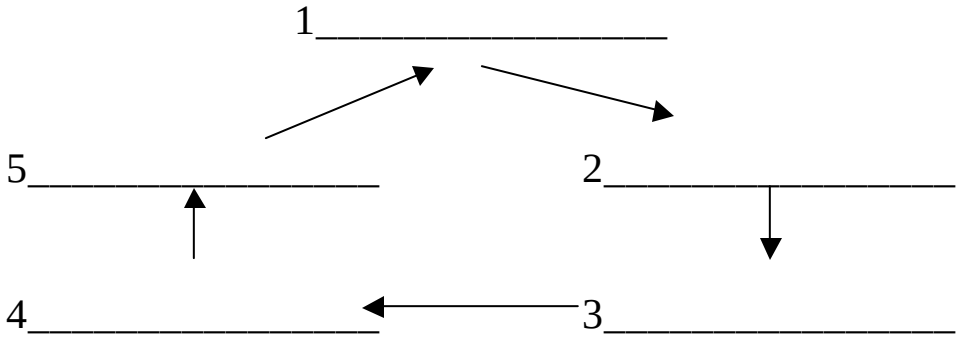


1. Chromosomes uncoil.
2. Nucleolus reappears.
3. Nuclear membrane reappears.
4. Spindle breaks down.
5. Cytokinesis occurs.

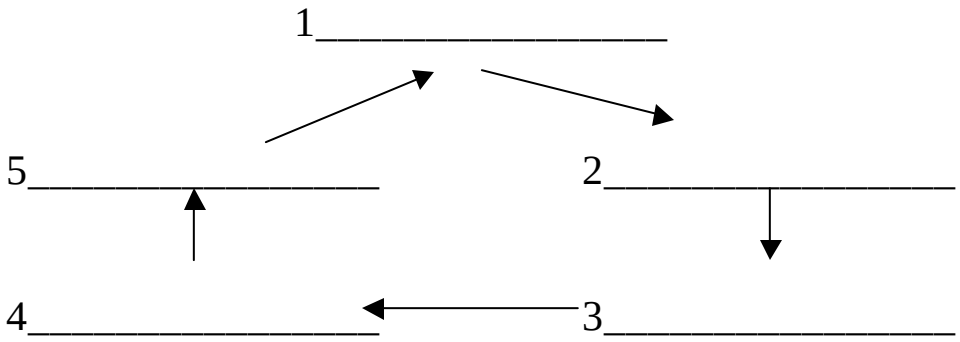
Key Term:
Cytokinesis: the division of the cytoplasm.

Appendix B

Let's see what you know. Put the following terms in order: Prophase, Telophase, Anaphase, and Metaphase, Interphase



Let's Try Again.



1. _____
_____
2. _____
_____
3. _____
_____
4. _____
_____
5. _____
_____

Appendix B, page 2

1. Recall your height and/or weight from two years ago. Compare these figures with your present height and weight. What kinds of cells in your body increased in number? What cells do you think increased the most?

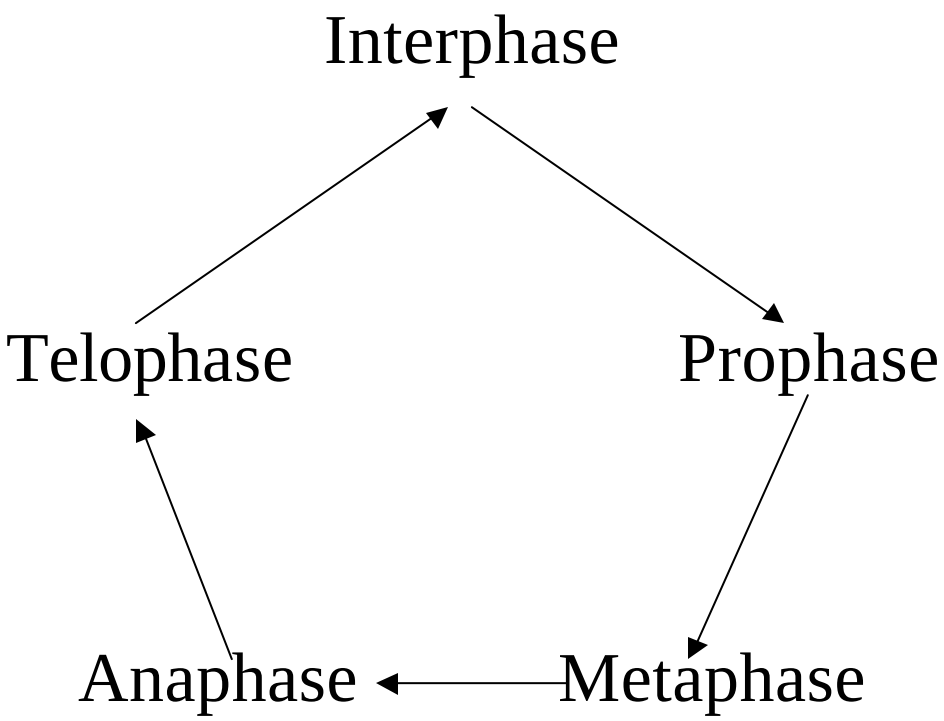
2. If you were to divide the cell cycle into two parts what would they be?

3. For each individual cell, when does the cell cycle begin?

4. What happens to each of the chromosomes in the nucleus during interphase, and why is this important?

5. When are chromosomes visible?

Appendix C



Appendix E1

The Cell Cycle Booklet
Rubric

	4	3	2	1
Neatness	Easily read penmanship, paper is neat, no stray marks	Easily read penmanship, paper is neat, one or two stray marks (small)	Mostly neat penmanship, paper is slightly crumpled, one or two stray marks (small to medium)	Hard to read penmanship, paper crumpled, many stray marks
Conventions	No convention errors	One or two minor convention errors	3-5 convention errors	Many errors
Events of each phase	Each phase has all events filled in	Only one incomplete from the whole booklet	Only one event missing from the whole book	Two or more events missing
Key words highlighted and defined	All key words are highlighted and defined	Some highlighting missing, but all words are defined	Some highlighting is missing and one word is not defined.	Highlighting is missing, missing definitions
Summary	Each phase is completely explained in the summary, having at least one sentence	Each phase is explained but one is incomplete	One phase is not explained	Two or more phases are not explained, or all are incomplete

Appendix E2

The Cell Cycle

Interphase

G1_____
_____
_____

S _____
_____
_____

G2 _____
_____
_____

Key Term _____
_____
_____

1. List the phases of the cell cycle in order?

2. When are the chromosomes copied during the cell cycle? (Be specific)

3. Which is not a phase of mitosis?
   A. Prophase B. Metaphase C. Interphase
   D. Telophase E. Anaphase

4. During which stage of interphase has the most growth occurring?

5. Which organelles would be need to be copied before beginning mitosis? When would this occur?

6. During which part of the cell cycle does the cell spend most of its time?

Appendix E3

The Cell Cycle

PROphase

1. _____
2. _____
3. _____
4. _____
5. _____

Key Term(s)_____

_____
_____
_____
_____
_____
_____
_____

1. Why would it be necessary for the chromosomes to coil before continuing with mitosis?

2. Why does the nucleolus disappear?

3. _____ is the first and the longest phase of mitosis.

4. The opposite ends of the cell are referred to as _____.

5. The _____ organize the spindle.

6. The last phase of mitosis is _____.

7. _____ is the shortest phase of mitosis

8. The process of copying chromosomes is referred to as _____.

9. The third phase of mitosis is called _____.

10. During prophase the nuclear membrane _____.

Appendix E4

The Cell Cycle

mETAphase

1. _____
   _____
   _____

1. Why would it be necessary to line up chromosomes in one place?

Interphase = I Prophase = P Metaphase = M

_____1. Nuclear membrane disappears.

_____2. Chromosomes line up at the center of the cell.

_____3. Spindle forms.

_____4. Some growth, mostly of organelles needed for mitosis

_____5. Centrioles move to opposite poles.

_____6. Growth, production of organelles, cytoplasm, and proteins.

_____7. Replication of DNA

_____8. Chromosomes coil.

_____9. Nucleolus disappears.

Appendix E5

The Cell Cycle

ANaphase

1. _____

_____

2. _____

_____

Key Term(s)_____

_____

_____

_____

_____

_____

_____

_____

Interphase = I Metaphase = M
Prophase = P Anaphase = A

_____1. Nucleolus disappears.

_____2. Replication of DNA

_____3. Spindle forms.

_____4. Centromeres split.

_____5. Some growth, mostly of organelles needed for mitosis

_____6. Chromosomes coil.

_____7. Growth, production of organelles, cytoplasm, and proteins.

_____8. Chromatids move to opposite poles

_____9. Nuclear membrane disappears.

_____10. Centrioles move to opposite poles.

_____11. Chromosomes line up at the center of the cell.

Appendix E6

The Cell Cycle

PROphase

1. _____
2. _____
3. _____
4. _____
5. _____

Key Term(s)_____

_____
_____
_____
_____
_____
_____
_____

Interphase = I Metaphase = M Telophase = T
Prophase = P Anaphase = A

_____1. Growth, production of organelles, cytoplasm, and proteins.

_____2. Chromosomes uncoil

_____3. Spindle forms.

_____4. Centromeres split.

_____5. Some growth, mostly of organelles needed for mitosis

_____6. Nucleolus disappears.

_____7. Nuclear membrane reappears.

_____8. Spindle breaks down.

_____9. Replication of DNA

_____10. Centrioles move to opposite poles.

_____11. Chromosomes line up at the center of the cell.

_____12. Nucleolus reappears.

_____13. Chromatids move to opposite poles

_____14. Cytokinesis occurs

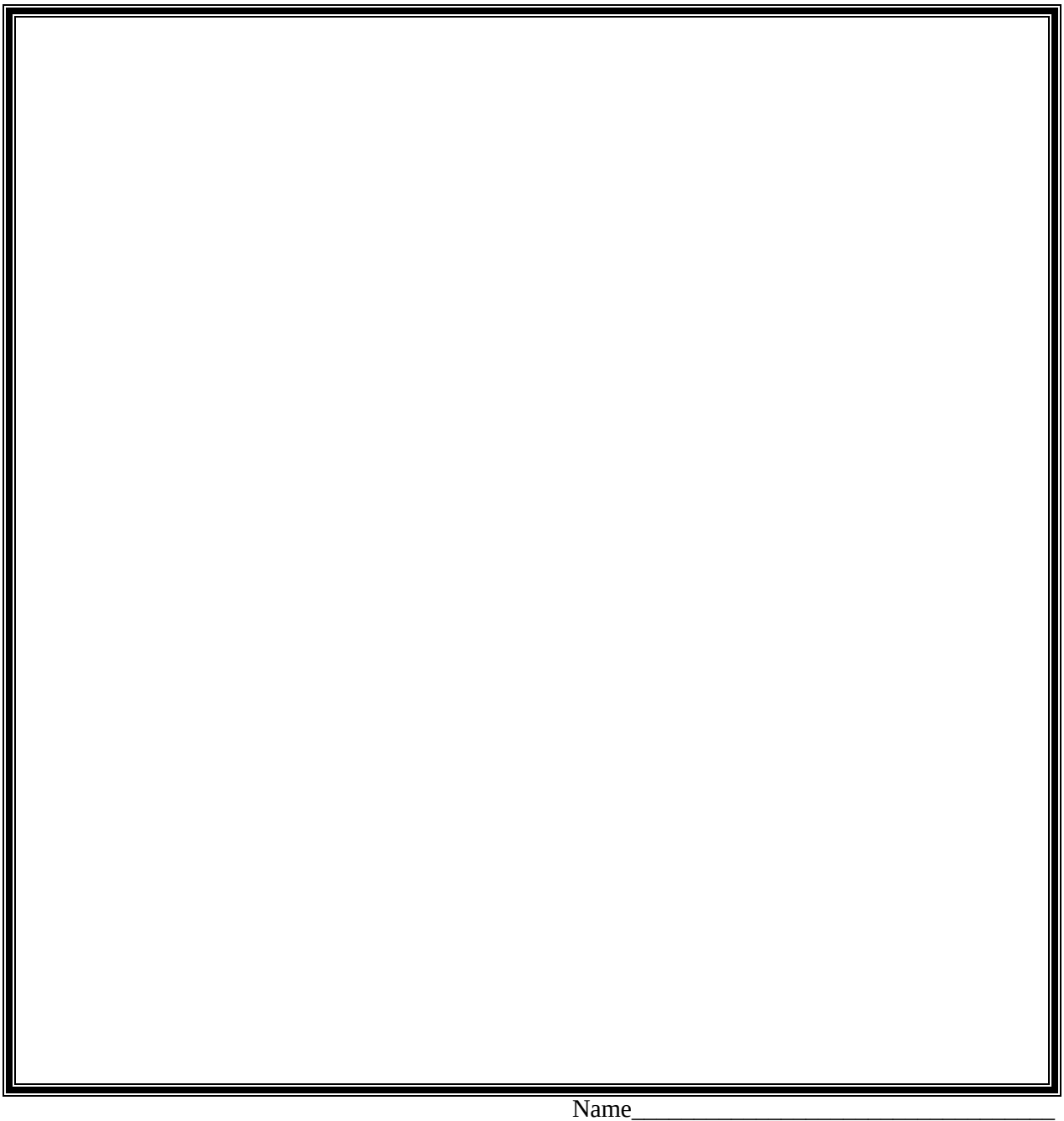
_____15. Nuclear membrane disappears.

_____16. Chromosomes coil.

Appendix E7

The Cell Cycle

Appendix E8



Name_____
Date _____

Appendix F

_____1. Pairs of identical chromatids are attached to each other at an area called the
A. Centriole B. Spindle
C. Chromatids D. Centromere

_____2. At the beginning of cell division, a chromosome consists of two
A. Centromeres B. Chromatids
C. Centrioles D. Spindle

_____3. The phase of mitosis during which chromosomes become visible and the centrioles separate from one another is
A. Prophase B. Metaphase
C. Anaphase D. Telophase

_____4. The division of the cytoplasm is called
A. Chromatids B. Interphase
C. Cytokinesis D. Karyokinesis

_____5. Plant cells produce a _____ between the two forming nuclei during telophase.
A. Cell plate B. Centrioles
C. Chromatids D. Cytokinesis

The chromatids are identical. Why?

Explain how the following terms are related to each other: DNA, Centromere, Chromosome, Chromatid.