

Dude, mitosis starts in five minutes...
I can't believe you're not condensed yet.

CELL GROWTH, CELL REPRODUCTION AND MITOSIS

NAME _____ p _____

Goals

My goal for this packet is.....

My goal for 3rd Qtr is.....

I know I have accomplished this goal when....

Cell Growth and Division Vocabulary

Anaphase - Twin copies of the chromosomes get separated and move to the opposite sides of the cell.

Cell Division- The method of one cell dividing into two cells. Mitosis, Meiosis

Cell plate - The site of growth of a new cell wall between the two new daughter cells in the mitosis of plant cells.

Centromere - Site of attachment for sister chromosomes. Spindle fibers attach here.

Chromatids- A chromatid is one of the two identical copies of DNA making up a duplicated **chromosome**, which are joined at their **centromeres**, for the process of cell division.

Chromatin - Threadlike coils of chromosomes.

Chromosome -Rod-shaped cell structure that directs the activities of the cell and passes on the traits to new cells.

Condensing- The shortening of the thread-like chromatin into the visible chromosomes.

Cytokinesis - The division of the cytoplasm in the cell.

Daughter cells - The two new cells formed by cell division.

Furrow - The site of pinching of the cell membrane during cytokinesis.

Interphase- First phase of cell division. Normal cell function. Chromosomes copied.

Metaphase- Chromosomes move to the middle of the cell. Chromosomes attach to the spindle fibers at the centromere.

Mitosis- The process of duplication and division of the nucleus of a cell and the formation of two new daughter cells.

Phase- Cell division is broken down into different parts called cells.

Prophase- Mitosis begins. Nuclear membrane disappears, chromatin shortens to become Chromosomes, centrioles move to opposite ends of the cell, spindle fibers form.

Sister chromosome - The duplicated chromosome that separates from the original during
Cell division

Spindle - Thread- like fibers attached to the chromosome pair that help separate the
chromosomes during cell division.

Telophase- Chromosomes begin to uncoil to form chromatin, nuclear membrane reforms,
nucleolus reappears, mitosis is complete.

Additional notes:

5.1 Guided Reading

DNA, RNA, and Protein Synthesis

As you carefully read through the text, answer the following questions as completely as possible!

Introduction

1. What is DNA? What is its function?

What is DNA?

2. DNA is an abbreviation for _____.

3. What does the “deoxyribo” part of the name refer to?

4. DNA is made of a long chain of _____.

5. List the three components of a nucleotide.

6. What is the only difference between each nucleotide?

7. List the four possible bases along with their abbreviation.

8. If there are only four letters in the “alphabet” of DNA, how can it encode all of the different genes in your cells?

9. Who discovered the structure of DNA? Whose data helped these gentlemen make their discovery?

10. Describe the structure of DNA.

Base-Pairing

11. Who discovered that DNA bases pair in a certain way?

12. Chargaff's data showed that in DNA, the percentage of adenine (A) always equaled the percentage of _____, and the percentage of guanine (G) always equaled the percentage of _____.

13. How did Watson and Crick's model explain Chargaff's findings? Explain.

14. What is meant by "complementary bases?"

DNA Replication

15. Explain when DNA replication occurs.

16. Summarize the three steps of DNA replication.

Protein Synthesis

17. The DNA sequence contains the instructions to make units called _____, which are assembled in a specific order to make _____.

18. What are genes? Explain.

Cells Can Turn Genes On or Off

19. There are about _____ genes in every human cell.

20. Does every human cell have the same genes? Does every human cell use the same genes to make the same proteins? Explain.

Three Types of RNA

21. DNA contains the instructions to make _____, but it does _____ make the proteins itself.

22. DNA is located in the _____, while proteins are made on the _____ in the cytoplasm.

23. DNA needs a messenger to bring its instructions to a ribosome located _____ the nucleus.

24. DNA sends out a message, in the form of _____, describing how to make the protein.

25. Describe the three types of RNA involved in protein synthesis.

26. All three RNAs are nucleic acids. The RNA nucleotide is different from DNA. Describe these three differences.

Transcription

27. Messenger RNA (mRNA) is created by using DNA as a _____.

28. What is transcription? Explain.

29. Describe the processes of transcription.

Translation

30. What is translation?

31. During translation three bases, called _____, are read in the ribosomes.

32. The ribosomes are the organelle responsible for making _____, which are linked together to make _____.

33. Summarize the five steps involved in translation.

Mutations

34. A permanent change in the sequence of DNA is known as a _____.

35. A mutation can cause the protein to be made incorrectly, which can affect how well the protein _____, or whether it works at all.

36. What are the three types of mutations?

37. What is a major mutation?

38. What is a minor mutation?

39. What is a neutral mutation?

40. Mutations can happen spontaneously or they can be caused by _____ in the environment.

41. List several types of mutagens.

5.2 Guided Reading

Mitosis

As you carefully read through the text, answer the following questions as completely as possible!

Introduction

1. Your DNA is organized into _____; however, they are only tightly wound and visible when the cell is ready to _____.

Why Cells Divide

2. According to cell theory, all cells must come from _____ cells.

3. Explain how a new life goes from one cell to many.

4. What is the difference between an embryo and a zygote? Explain.

5. List and explain why cell division is necessary for life.

The Cell Cycle

6. What is the “cell cycle?”

7. List and explain the two main components of the cell cycle.

8. List and describe the three important changes that occur during interphase.

9. During mitosis, the _____ divides.

10. During mitosis, the parent cell (the dividing cell), forms two genetically identical _____ cells.

11. What does “genetically identical” mean?

12. What is cancer? Explain.

Mitosis and Chromosomes

13. The genetic information of the cell (DNA) is stored in the cell’s _____.

14. During _____, two nuclei must form so that one nucleus can be found in each daughter cell.

15. To begin mitosis, the DNA in the nucleus wraps around _____ to form _____.

16. In human cells, the DNA is divided into _____ pairs of chromosomes.

17. After DNA is replicated at the end of interphase, each chromosome has two identical molecules of DNA, called _____.

The Four Phases of Mitosis

18. During mitosis, the two sister chromatids must be _____ apart and through this process each daughter cell receives one copy of each _____.

19. List and describe the four phases of mitosis.
20. At the end of mitosis each new daughter cell must contain the exact same number and type of _____ as the parent cell.

Applying Concepts

21. Interphase is considered the “resting” stage of the cell cycle. Why is this technically incorrect?
22. What are some of the reasons that cells divide?
23. What would happen if the cells in your liver stopped going through the process of mitosis?

5.3 Guided Reading

Reproduction and Meiosis

As you carefully read through the text, answer the following questions as completely as possible!

Introduction

1. Do animals always have two parents? Explain.

What is Reproduction?

2. What is reproduction?
3. What are the two methods of reproduction?

Asexual Reproduction

4. What does it mean to reproduce asexually?
5. What are the advantages of asexual reproduction?
6. What are the disadvantages of asexual reproduction?

7. List several types of organisms who can reproduce asexually.

Sexual Reproduction

8. During sexual reproduction, _____ parents are involved, with the male producing _____ and the female producing _____.

9. When a sperm and egg meet, a _____, the first cell of a new organism is formed.

10. The zygote will divide and grow into the _____.

11. The sperm and egg, the two sex cells, are known as _____.

Meiosis and Gametes

12. What is meiosis? Explain.

13. As gametes are produced through meiosis, the number of chromosomes must be reproduced by half? Why? Explain.

14. In humans, our cells have 23 pairs of chromosomes, or 46 total. How many chromosomes did you get from your mother? How many from your father?

15. Describe the three steps of meiosis.

16. What are alleles?

17. Since the separation of chromosomes into gametes is random, it results in different combinations of _____ (and alleles), in each _____.

18. With 23 pairs of chromosomes, there is a possibility of _____ different combinations of chromosomes in a gamete!

Haploid vs. Diploid

19. A cell with two sets of chromosomes is _____, referred to as _____, where n is the number of sets of chromosomes.

20. A cell with one set of chromosomes, such as a gamete, is _____, referred to as n . Sex cells are haploid.

21. When a haploid sperm (n) and a haploid egg (n) combine, a _____ zygote is formed ($2n$).

22. When a diploid zygote is formed, half of the DNA comes from each _____.

MITOSIS COLORING HOMEWORK

Many, many years ago (actually probably around 13 years ago) you were made of just one cell. Yes, you were just one tiny cell that people needed a microscope to see. Then one day that cell underwent *mitosis*, which means *cell division*. Everything inside that cell was copied (the nucleus, the mitochondria, the vacuoles, all the DNA, etc.) so that when the cell split, both the new cell and the old cell would have everything they needed to survive. These two cells then each underwent mitosis so that these two became four cells, and those four cells became eight, and then sixteen cells, and then thirty-two cells and so on. Eventually, there enough cells so that a beautiful bouncing baby was born (that's you). But it didn't stop there! You'd look pretty funny as a 7 pound 7th grader, so instead your cells continued going through mitosis making more and more cells. That's why you are bigger today than when you were born. You have more cells (but NOT bigger cells) than when you were a baby. Elephants have more cells than you do but the cells they have are about the same size as yours.

Louis Pasteur taught us that no living thing, not even cells or bacteria, can pop into being out of nowhere. Everything has to come from somewhere; every living thing has to have parents of some kind. All living things are made of cells and all cells come from other cells (kind of makes you wonder where the very first cell came from then doesn't it?!?). So as you can see, mitosis is the basis of all life! Let's find out how it works.

Mitosis is a process that can be broken down into 4 steps. These steps are called *Prophase*, *Metaphase*, *Anaphase*, and *Telophase*. A phase called *interphase* is not actually part of mitosis, but is the resting phase that the cell is in when it is not dividing.

Interphase. Most of the time, a cell is not actually dividing. Instead it spends most of its time just resting and performing cell activities like cellular respiration, osmosis, and for plant cells, photosynthesis. During interphase, DNA and other cell materials are copied. While in interphase, the DNA is shaped like uncoiled strands that look like spaghetti. When it is in this shape, it is called *chromatin*. When DNA is loosely packed like this it is much easier for the cell's machinery to copy.

Prophase. This is the first step of mitosis. The *nuclear membrane* (membrane around the nucleus) breaks apart. *Chromatin* condenses into rod-like structures called *chromosomes*. Take a look at the other side of this paper and find something inside any of the cells that looks like a big fat X. This is a chromosome that has been copied. One half of the X is the original chromosome and the other half is the copy.

Another thing that happens during Prophase is that the *centrioles* move to opposite sides of the cell and *spindle fibers* form across the cell. We'll find out what these do later...

Metaphase. During this stage of mitosis the chromosomes line up in the middle of the cell, right along the *equator*. Each chromosome attaches itself to a spindle fiber.

Anaphase. The centrioles act like fishermen and start to reel in their fish (the chromosomes) using the spindle fibers as line. During anaphase the twin copies of the chromosomes get separated and each copy moves to opposite sides of the cell.

Telophase. Now that the chromosomes are separated, two new cells are formed. The spindle fibers disappear; the chromosomes uncoil and become spaghetti-like chromatin again. The nuclear membrane reappears and finally the cytoplasm divides to form two new daughter cells which are identical to each other. In a plant cell, a cell wall forms between the two new cells.

Questions: Answer these questions by following the directions in each one and using the pictures on the coloring page. The questions do not necessarily go in order.

1. Outline the cell membrane of the cells in these colors:

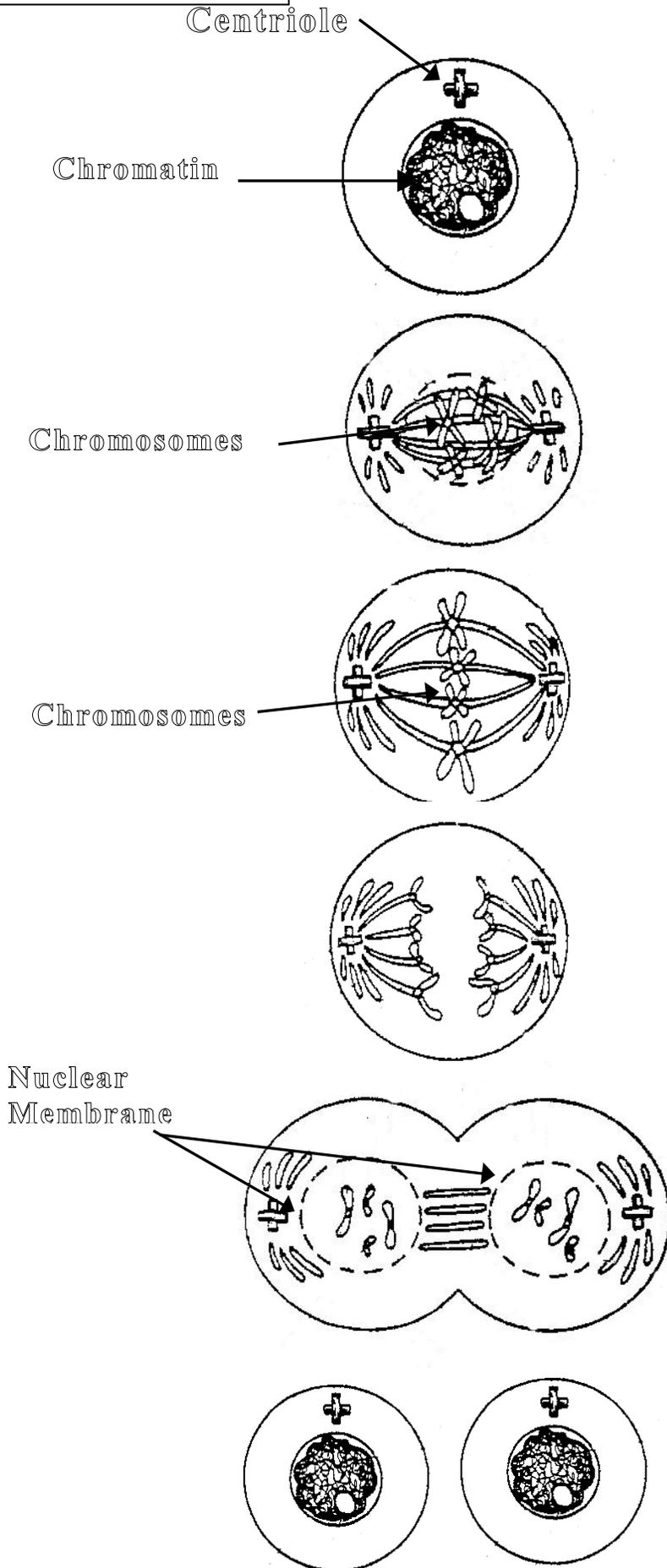
Prophase cells—red Metaphase cells—green Anaphase cells—yellow

Telophase cells—orange Interphase cells—purple

2. What is the name for the resting period between cell divisions? _____.
Color the word brown.
3. In interphase, the DNA is in the form of loose threads called _____. Color the word and pictures blue.
4. Condensed DNA is called _____. Color the word and these structures in metaphase cells green.
5. During metaphase the chromosomes line up along the middle of the cell called the _____. Write the answer in the top left corner on the other side of this paper.
6. During what stage do the chromosomes pull apart? _____. Color the word yellow.
7. Another name for cell division is _____. Color the word blue.
8. What structure reappears during telophase? _____
Outline this structure in the telophase cells with red.
9. During which stage does the DNA copy itself? _____. Draw an orange star next to this word.

MITOSIS

Coloring page



INTERPHASE



PROPHASE



METAPHASE



ANAPHASE



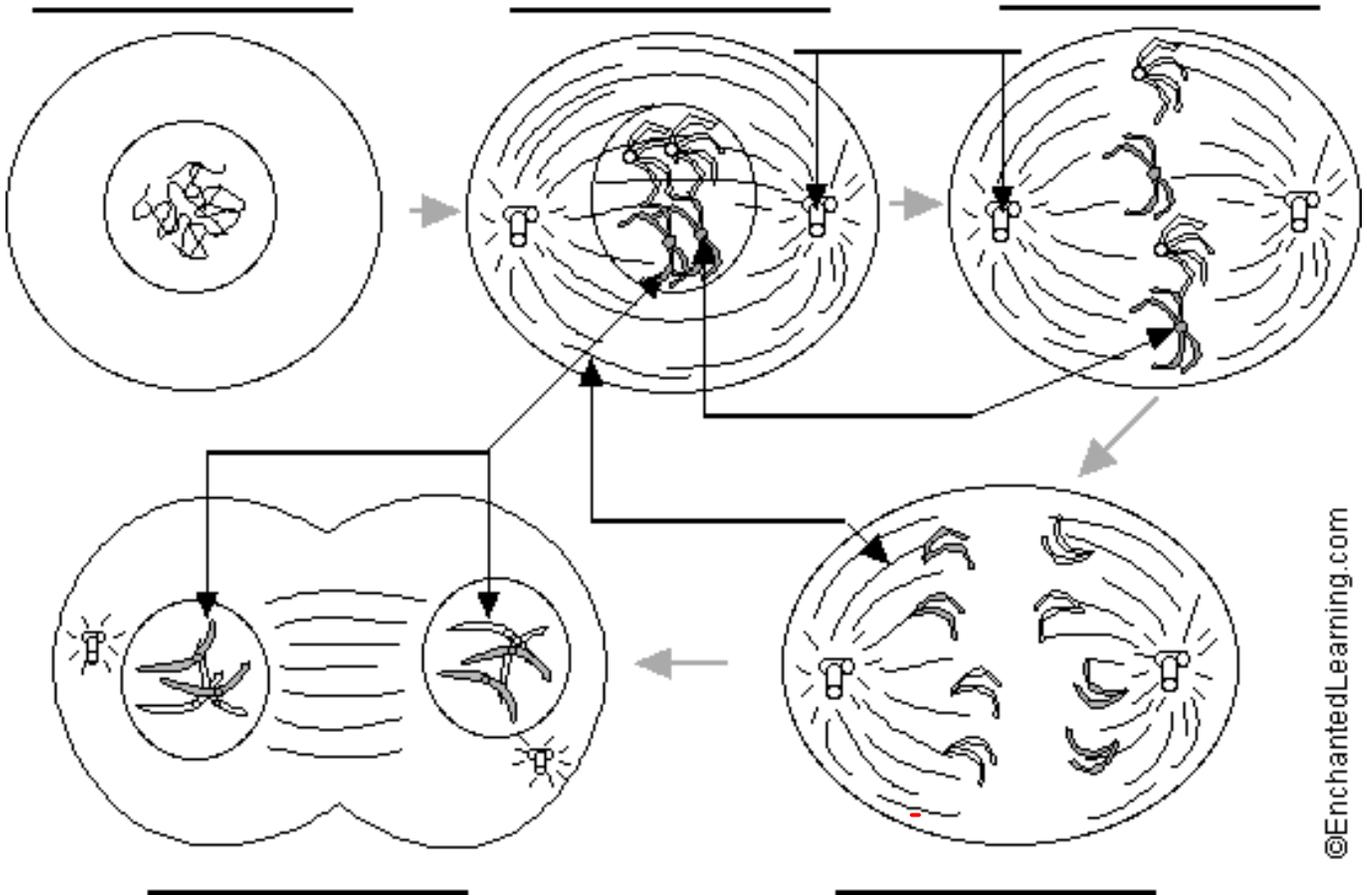
TELOPHASE



**2 NEW DAUGHTER
CELLS ARE FORMED**

Label the stages of mitosis in the below diagrams. COLOR the stages as follows --- interphase-pink, prophase-light green, metaphase-red, anaphase-light blue, and telophase-yellow. Also label the CENTRIOLES, SPINDLE FIBERS, CENTROMERE, and CHROMOSOMES. Color the centrioles purple, spindle fibers brown, centromeres dark blue and the chromosomes orange.

Mitosis of an Animal Cell



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Cell Division Drawings

A

Label chromosomes.

Label whether or not DNA has been "copied".

Label two errors in the model (explain two inaccuracies in the model)

Under "A" write the name of this phase of cell division.

Also under "A" explain what happens to the DNA and what DNA is called when it is not seen.

B

Label chromosome pair, chromatid, centromere.

When labeling centromere also explain what it does.

Under "B" label the name of this phase of cell division.

Also under "B" explain what happens to chromosomes so we can "see" them.

C

With a pencil sketch in the spindle and centriole, color the spindle blue and centriole red

Label spindle, centriole, chromosome pair, chromatid

Under "C" label the name of this phase of cell division.

Also under "C" explain how the chromatids organize themselves.

D

With a pencil sketch in the spindle & centriole, color the spindle blue & centriole red

Label spindle.

Label sister chromatids separate.

Under "D" label the name of this phase of cell division.

Also under "D" explain what happens to the chromatids, and explain what they are called now.

E

Label chromosome (uncoiling), centromere

Under "E" label the name of this phase of cell division

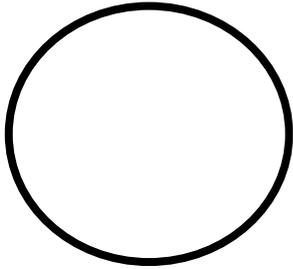
Also under "E" explain what happens to the chromosomes at this time and explain what they become.

Questions: Answer on the back of the poster

1. What is happening in the cell from the 1st through the 5th stage.
2. Strands are genetic material. How does it appear in stage 1.
3. What happens to the genetic material in B and C?
4. How does E (both of them) compare to A? And how do they compare to each other

Label:

Chromosome
Whether DNA has been copied
Two errors in the model (explain two inaccuracies in the model)

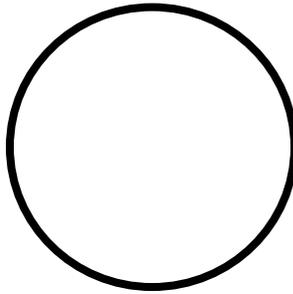


A
Name

Explain what happens to the DNA and explain what DNA is called when it is not seen.

Label:

Chromosome pair
Sister chromosomes
Centromere
Chromatid
When labeling centromere also explain what it does.



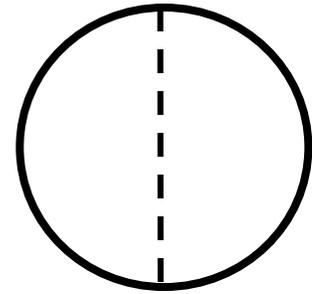
B
Name

Explain what happens to chromosomes so we "see" them.

Label:

Spindle
Centriole
Chromatid
Chromosome pair

Use a red marker to add spindle and blue marker to add centrioles

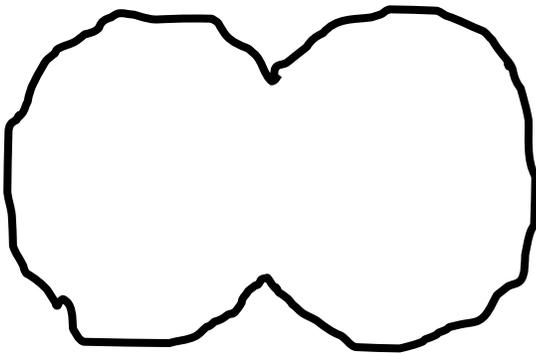


C
Name

Explain how the chromatids organize themselves at this time

Label:

Spindle
Centriole
Sister chromosomes

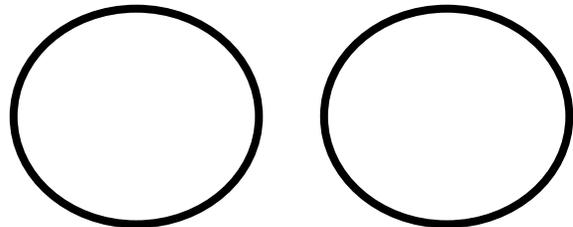


D
Name

Explain what happens to the chromatids, and explain what they are called now.

Label:

Chromosomes (uncoiling)
Centromere

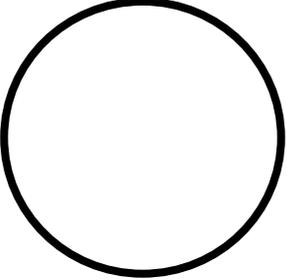
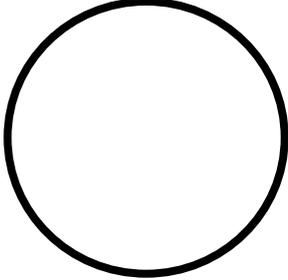
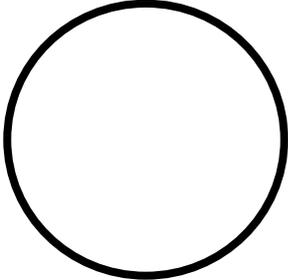


E
Name

Explain what happens to the chromosomes at this time and explain what they become.

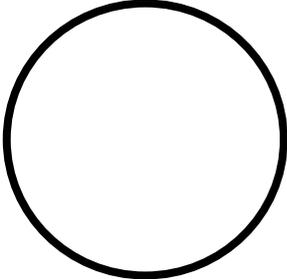
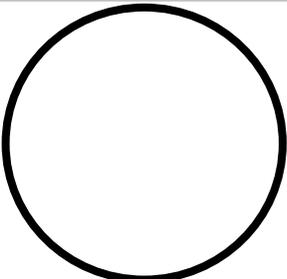
Problem: How do the phases of mitosis appear under a microscope?

2. Place the slide on the stage of the microscope and find the stages of mitosis.
3. Compare the stages on the slide to the drawing of the stages in the textbook on pages 90 and 91.
4. Draw and label the stages of mitosis (include interphase).

Stage of Mitosis _____		Stage of Mitosis _____		Stage of Mitosis _____	
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Procedure:

1. Obtain a prepared slide that shows mitosis in cells (*Allium* root tip l.s.).

Stage of Mitosis _____		Stage of Mitosis _____	
---------------------------	--	---------------------------	---

Analysis and Conclusions:

1. What occurs during cell division? _____

2. How is mitosis different from cell division? _____

3. List the stages of mitosis in the proper order.
1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____
4. To which structures do the chromosomes become attached during prophase? _____
5. Based on your plate drawing describe the entire process of mitosis? Use a minimum of 30 words.

6. Why are the daughter cells produced by mitosis exactly like the parent cell?

Critical Thinking and Application

7. If the chromosomes of a cell do not duplicate during mitosis, how many chromosomes does each daughter cell have?

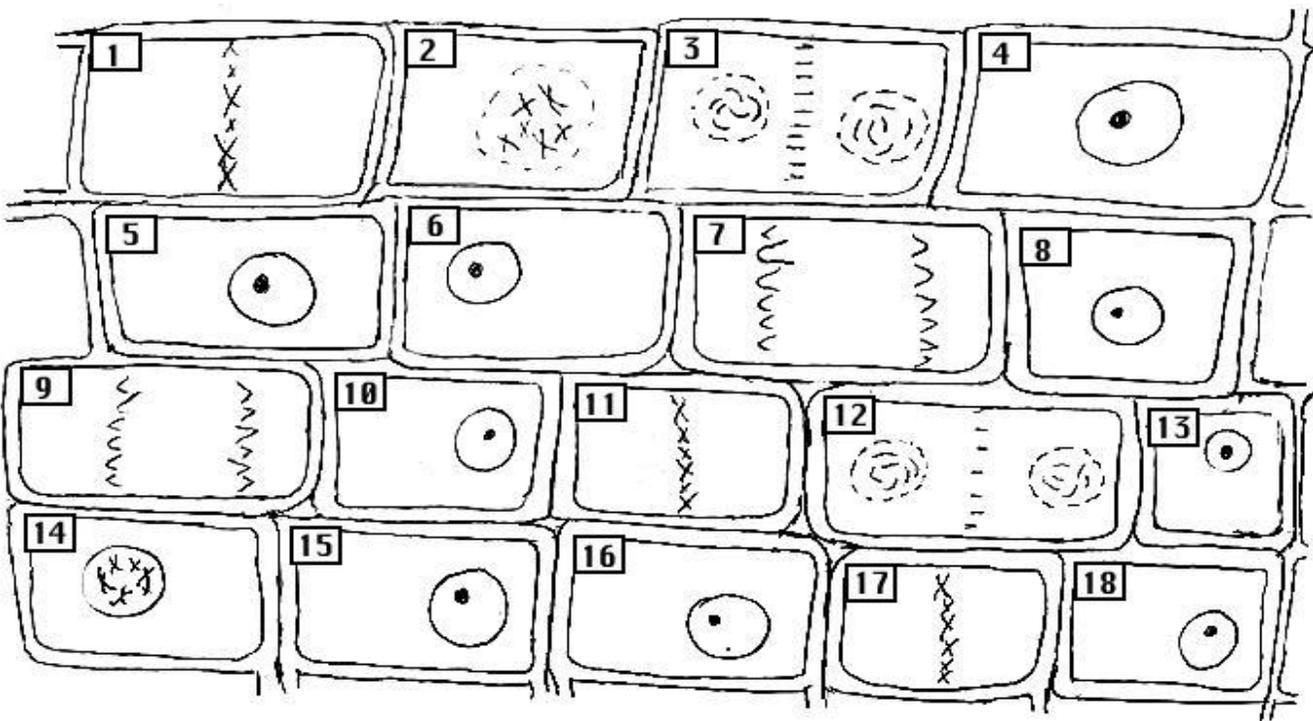
8. Would the daughter cells in question seven be identical to the parent cell? Explain.

9. Why was onion root tip cells used for observing mitosis?

10. Name each numbered stage in the plant cell diagram below. Choices: Interphase, Prophase, Metaphase, Anaphase, or Telophase.

1. _____	2. _____	3. _____
4. _____	5. _____	6. _____
7. _____	8. _____	9. _____
10. _____	11. _____	12. _____
13. _____	14. _____	15. _____
16. _____	17. _____	18. _____

Plant Cells in Mitosis



Cells Alive- Internet Lesson URL: www.cellsalive.com

Objective: Look at computer models of mitosis, describe the dividing cell and its components.

Navigating the site: After accessing the page, click on CELL BIOLOGY found on the left side navigation bar. From here, you will access the link: Mitosis. Animal cell mitosis animation demonstrates the stages of mitosis. Use the control buttons in the upper left to run the complete animation. Click on any stage (for example anaphase) and see a still frame.

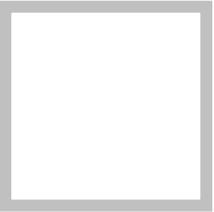
Sketch Interphase



Label centrioles the nucleus in interphase.

In interphase cells are active. Explain.

Sketch Prophase

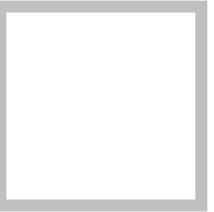


In prophase what happens to the nucleus? _____

In prophase what happens to the DNA? _____

In prophase what happens to the spindle? _____

Sketch Metaphase



In metaphase what happens to the chromosomes? _____

What moves the chromosomes? _____

Sketch Anaphase



During anaphase what happens to the chromosomes? _____

Sketch Telophase



During telophase what happens to the chromosomes? _____

What happens to the spindle _____

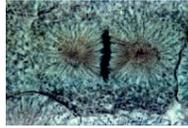
What happens after telophase? _____

Mitosis Tutorial

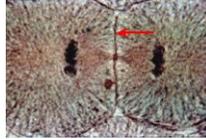
Website: http://biog-1101-1104.bio.cornell.edu/BioG101_104/tutorials/cell_division.html

Review the whitefish mitosis.

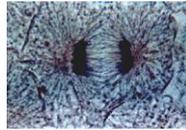
1. Which stage is this _____?
What is happening in this stage? _____



2. Which stage is this _____?
What is happening in this stage? _____

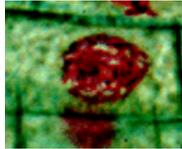


3. Which stage is this _____?
What is happening in this stage? _____



Review the Onion Root tip mitosis.

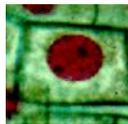
4. Which stage is this _____?
What is happening in this stage? _____



5. Which stage is this _____?
What is happening in this stage? _____



6. Which stage is this _____?
What is happening in this stage? _____

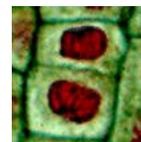
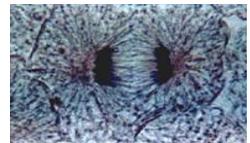


7. Which stage is this _____?
What is happening in this stage? _____



Take the quiz, do questions 1-6.

1. Stage of mitosis shown _____ Double-chromatid chromosomes present: _____
2. Stage of mitosis shown _____ Structure indicated: _____
3. Stage of mitosis shown _____ Draw an arrow to the place cytokinesis will occur: _____
4. Stage of mitosis shown _____ Structure indicated: _____
5. Stage of mitosis shown _____ Ploidy state of cell and condition of chromosomes: _____
6. Stage of mitosis shown _____ Draw an arrow to the place where the cell plate is located: _____



Lew-Port's Biology Place Mitosis Animation

Website: google Lew-port mitosis and the search page should give you the below link, click on it

[Mitosis - Lew-Port.com](#)

Lew-Port's Biology Place, or use the text links at the bottom of this page. **Mitosis:** Mitotic cell division takes place in nearly all cells. ...

www.lew-port.com/10712041113402793/lib/.../mitosis.html - Cached - Similar

1.

How many chromosomes are in this cell? _____

2.

What is replicated? _____ How many chromosomes are there now? _____

3.

What are doubled chromosomes?" _____

4.

What is the equator? _____

5.

What happens to the doubled chromosomes? _____

6.

What forms around each set? _____

7.

How do the chromosome sets compare? _____

8.

What is dividing now? _____

Online Onion Root Tips

Objective: Determining time spent in different phases of the cell cycle

Objective: Recognize the processes cells go through to reproduce

URL: www.biology.arizona.edu/CELL_BIO/activities/cell_cycle/assignment.html

In this activity, you will be presented with cells from the tip of an onion root. You will classify each cell based on what phase it is in. At the end you will count up the cells found in each phase and use those numbers to predict how much time a dividing cell spends in each phase. You can base your calculation on a total cell cycle of 24 hours.

	Interphase	Prophase	Metaphase	Anaphase	Telophase	Total
Number of cells						
Percent of cells						

Mitosis Video Clip: Website

http://highered.mcgrawhill.com/sites/0072437316/student_view0/chapter11/animations.html#

Click on mitosis - cytokinesis to watch the video

1. Mitosis is what type of division? _____
2. What is formed by mitosis? _____
3. What is formed during prophase
 - a. _____
 - b. _____
4. What are kinetochores? _____
5. What do the chromosomes do during metaphase? _____
6. What moves the chromosomes a part? _____
7. Where are the chromosomes during telophase? _____
8. What happens to the nucleus during telophase? _____
9. What happens after telophase? _____

Cell Division

Discovery streaming video

1. How does all life **start**? _____
2. **How often** can bacteria divide/reproduce? _____
How many bacteria can a single bacterium become in less than **12 hours**? _____
Why is this called **asexual reproduction**? _____
3. For most kinds of life, reproduction requires **two parents**, a father and a mother. This type of reproduction is called _____.
Special cells for reproduction called _____ from each parent _____ together.
In **males**, they are called a _____. In **females** they are called _____.
A human **egg** is _____ of times larger than a sperm, but it is still tiny - **smaller** than a _____ left by a finely-sharpened pencil.
4. When the sperm and egg combine, these two cells **form a single cell** called a _____.
5. After fertilization, the **zygote divides** to form _____ cells, but instead of _____ like the cells of bacteria, they stay together.
These two cells in turn **also divide** so that there are _____ cells. This happens over and over again.
6. After awhile, the cells begin to **differentiate**, or _____.
7. **After 4 weeks**, different areas of cells begin to form _____.
8. By the end of **7 weeks**, the shape of a person begins to appear. A _____ become **distinguishable**, as well as **buds** that will become _____.
9. By the **fourth month**, such features become more distinct and _____.
10. **After birth**, cells continue to _____.
11. Throughout childhood, cell division makes it possible for our _____
12. But even when we reach our **full size**, **cells continue to divide**. For example, the body constantly makes _____ to replace cells that wear out and die.
13. This continues into old age. In fact, it **stops only** when we _____.
14. The **master plan** to tell which cell should divide and into what type of cell exists in **structures**, called _____

15. **Humans** have _____ **chromosomes**.
16. When a _____ & _____ **combine**, their chromosomes also combine so that **half** the chromosomes in the fertilized egg come from the **male parent** and the other half from the _____.
17. Each **chromosome contains** many different _____. These are distinct parts of a chromosome that control how different traits are developed.
18. There are over _____ **different genes on human chromosomes**, each containing specific instructions, but **only a very few** of these _____ in any single cell.
19. For example, genes for _____ are **switched on** when muscle cells are made.
20. When a **cell divides**, it makes a **complete** _____. In this way every _____ gets a complete copy of all the genetic instructions in the original cell.
21. The **process** through which most **cells divide** is called _____.
22. **After** the chromosomes have made **copies** of themselves, the chromosomes _____.
23. The **membrane of the cell's** nucleus begins to _____.
22. While the **twin chromosomes are still attached** to each other, they _____.
23. The **twin chromosomes** then _____ and move to opposite ends of the cell, and the cell pinches, dividing in two.
24. A _____ **forms around each set** of chromosomes. Each contains a complete set of chromosomes, and _____.
25. There is, however, an important **exception** to how cells divide. This exception occurs when _____ - sperm and eggs - are formed.
26. If human sperm and egg each (full set of 46 chromosomes) had a full set of chromosomes. When the sperm entered the egg, the resulting cell would then contain _____. The children would have _____ **the # of chromosomes** as their parents.
27. **Sperm and egg** cells have only _____ **the normal number of chromosomes**, because they are formed as a result of a different kind of cell division called _____.
28. Meiosis starts with special cells that are located in a **females** _____ and the **males** _____.
29. During meiosis cells then go through a _____ **round of cell division** and each of the **four cells** has _____ **number of chromosomes**.

