

Science 9

UNIT 4: BIOLOGY

WE ARE NEVER EVER
EVER



BOOK 2: THE CELL CYCLE, MITOSIS & ASEXUAL REPRODUCTION

name: Key block: _____

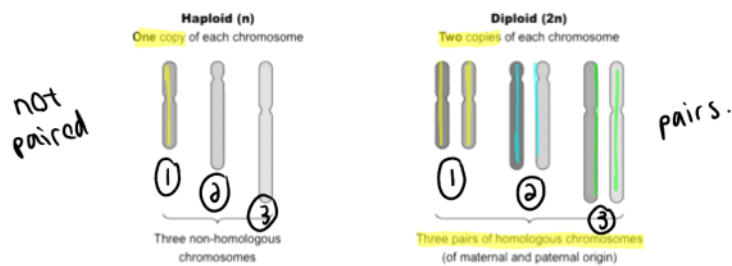
THE CELL THEORY

- The cell is the smallest living unit in all organisms.
- All living things are composed of one or more cells.
- All cells come from other / pre-existing cells.

Some More Important Terms ...

23 pairs ⇒ 46 TOTAL

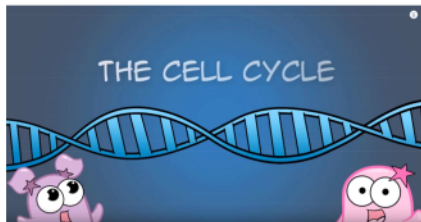
- Most cells have TWO (pairs) sets of chromosomes – one set from “mom” and one set from “dad”.
 ← “di” for two
- We say that these cells are diploid in their genetic information (two sets of chromosomes).
- Most body cells are diploid.
- Pairs of chromosomes are called homologous chromosomes.



- Cells that have only one set of chromosomes are haploid in their genetic information.
- All sex cells (sperm and egg cells) are haploid.
- Sex cells are also called gametes.



Amoeba Sisters: The Cell Cycle & Cancer
https://www.youtube.com/watch?v=Cjd_x_re



Why is the Reproduction of Cells Important?

How Do Cells Reproduce?

Why is cell reproduction important? (Brainstorm)

- growth
- repair
- method of reproduction for some unicellular organisms ex. bacteria.

CELL REPRODUCTION

The production of new cells from pre-existing cells is called **cell reproduction**. Cell reproduction happens because cells grow too large for to function properly. The cell must divide and produce more cells.

Let's think about several important events that happen during a life cycle. There are **4 main events** that happen during a life cycle:

- birth
- growth/repair
- reproduction
- death

REPRODUCTION & THE CELL CYCLE

Replacing damaged cells is not the only reason eukaryotic cells must reproduce. It is an essential part of an organism's life cycle. For single-cell eukaryotes such as amoebas the process of making new cells is how they produce new offspring.

For you and other multicellular eukaryotes different cells of the body have different life spans.

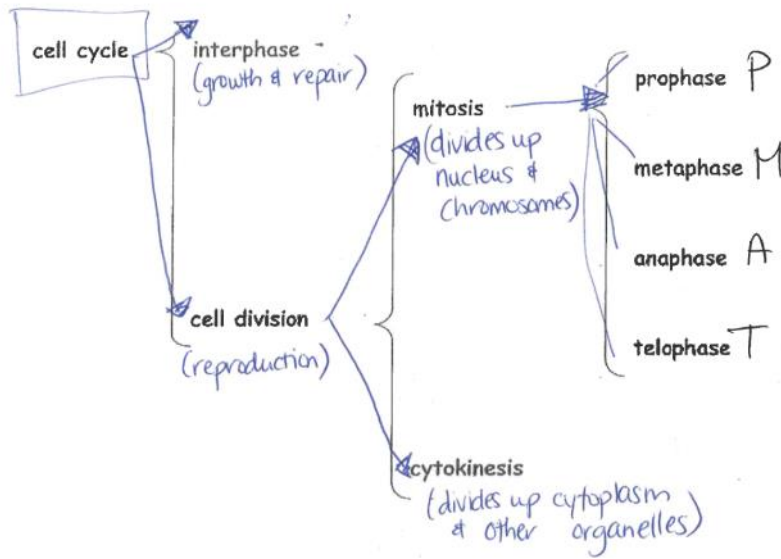
For example:

- cells of the colon live for a few days
- skin cells live a few weeks
- Red blood cells last for a few months and some white blood cells last more than a year.

All eukaryotic cells share this in common: They reproduced by a series of events called interphase mitosis and cytokinesis.

WHAT ARE THE PHASES OF A CELL CYCLE?

The cell cycle can be compared to the life cycle of an organism. We will focus on the growth/repair and reproduction of cells. What are the phases of a cell cycle?



CELL DIVISION: MITOSIS & CYTOKINESIS

The cell cycle is divided into 2 major phases: interphase and cell division. *← growth/repair*

Cell division is further divided into 2 major processes: mitosis and cytokinesis.



Amoeba Sisters: Mitosis

<https://www.youtube.com/watch?v=f-l-d-g-fAH>



5



Amoeba Sisters Video Recap of Meiosis

WRONG W/S.

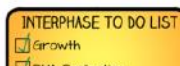
1. The purpose of meiosis is to make gametes, also known as sperm and egg cells. In humans, your body cells have 46 chromosomes. How many chromosomes are in a sperm or egg cell if, when they come together to form a fertilized zygote, there are 46 chromosomes? Write the correct number of chromosomes next to the sperm and egg.

23



2. Interphase must occur once before meiosis can happen. (Same thing for mitosis). What would happen if interphase didn't occur first?

If interphase did not occur first, then chromosomes would not replicate. This would not allow for chromosome copies to be correctly distributed in daughter cells.

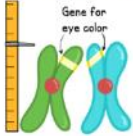


3. A cell that begins meiosis has 23 chromosomes inherited from the mother (shown in green in the cartoon below) and 23 chromosomes inherited from the father (shown in blue in the cartoon below). In the process of meiosis, chromosomes begin to match up in homologous pairs. How would you know if two chromosomes were homologous?

Homologous chromosomes are approximately the same size with the same types of genes (important: this does not mean identical). They can be found together in prophase I.

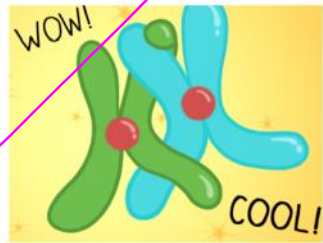


approximately the same size with the same types of genes (important: this does not mean identical). They can be found together in prophase I.



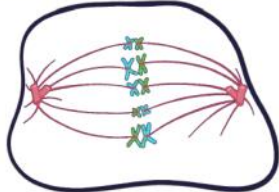
4. **Crossing over** is a very important event in Prophase I of meiosis! What happens during crossing over and what is the significance?

In crossing over, the homologous chromosomes transfer genes to each other. This is significant because it can lead to genetic variety (recombinant chromosomes).



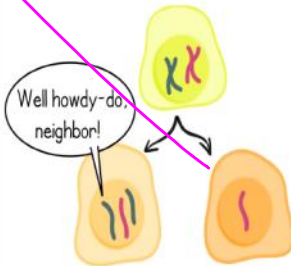
5. Meiosis does PMAT twice! That means there is a prophase I and a prophase II. There is a metaphase I and a metaphase II. Etc... If the cartoon below has chromosomes in the middle of the cell, how would you know whether it was in metaphase I or metaphase II?

Metaphase I has chromosomes lining up in the middle in homologous pairs. In metaphase II, the chromosomes are lined up in a single file line (not in pairs). The cartoon below shows metaphase I.



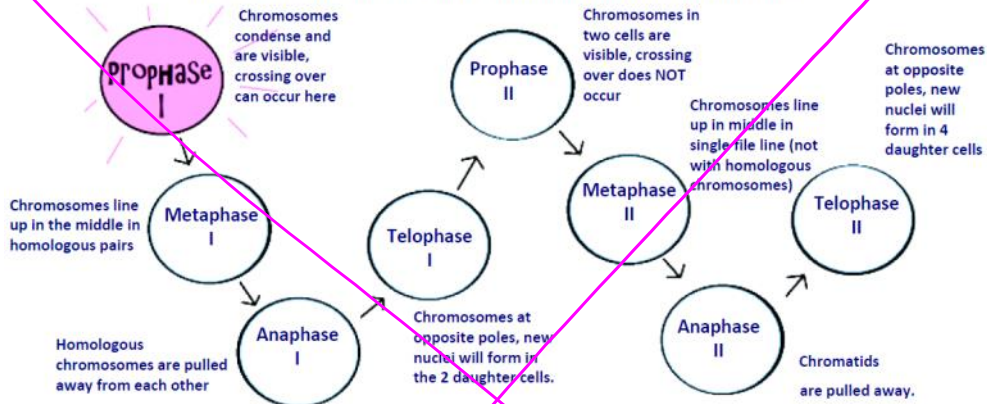
6. Meiosis does not always occur without any difficulties. Describe what occurs during nondisjunction and the effect on the resulting cells.

Chromosomes are not distributed equally (example could be spindle not separating them correctly). This can result in too many or too few chromosomes per cell.



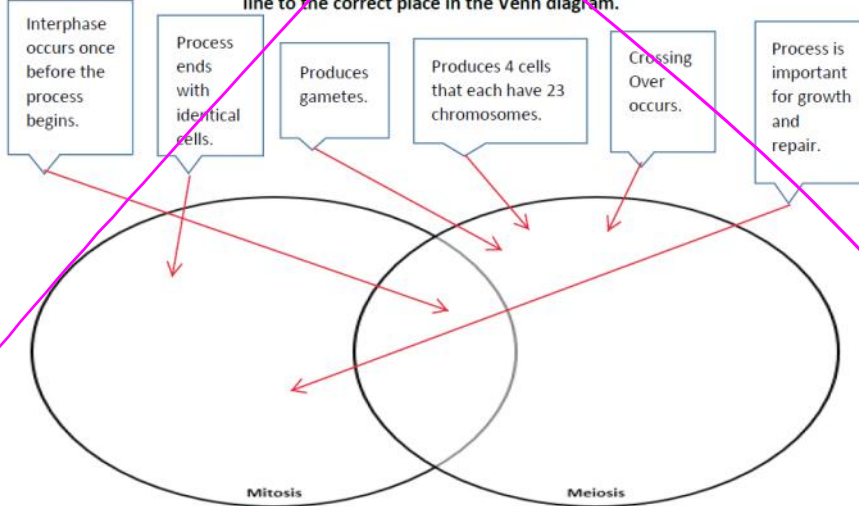
PRACTICE

Can you finish the meiosis chain? Write the correct stage that comes next in each circle. Don't forget the number that comes after the stage name! Then write any details about what this stage looks like next to it.



Now let's play, "Which Clip Would That Be Said In?"

Keeping mitosis and meiosis separate in your mind can be a bit tricky. Read the following speech bubbles. Determine whether they would be correctly placed in the mitosis clip, the meiosis clip, or both by drawing a line to the correct place in the Venn diagram.



Amoeba Sisters LLC

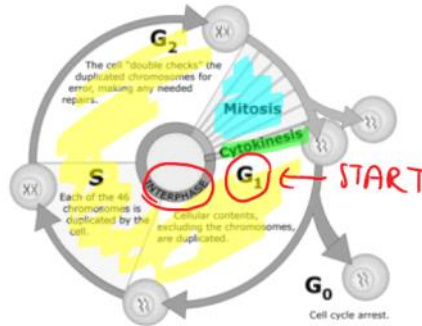
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Cell Division

- Cells divide to help organisms grow, and to replace & repair cells (GRR)
- The process of growing & dividing is called the cell cycle
- Before a cell can divide to become two smaller cells, several events must occur.
- If a cell is destined to divide, then it will COMPLETE the CELL CYCLE.
- If a cell is not destined to divide, then it will "arrest" or STOP partway in the cell cycle.

The Cell Cycle

- Consists of THREE stages:
 - G₁ (Growth #1)
 - S (Synthesis)
 - G₂ (Growth #2)
] INTERPHASE
 - Mitosis (NUCLEAR division)
 - Cytokinesis (CELLULAR division)

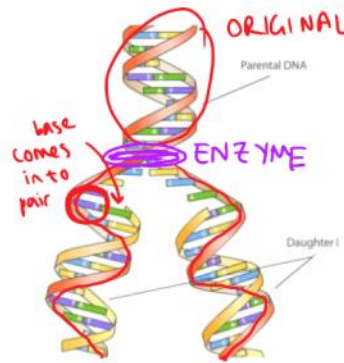


- * All together, G₁, S, G₂ are known as INTERPHASE.

- Imagine that a rapidly growing cell takes 24 hours to complete the cell cycle:
 - G₁ takes approximately 11 hours
 - S takes approximately 8 hours
 - G₂ takes approximately 4 hours
 - M takes approximately 1 hour
] 23 hours

The Cell Cycle – Interphase

- In G₁ cell organelles (other than chromosomes) are duplicated.
- In S each of the chromosomes is duplicated. An enzyme comes in and unwinds the DNA, so new bases can come in and pair.
- In G₂ the chromosomes are checked for errors and repairs are made. DNA is present as chromatin.
- Recall that G₁, S and G₂ are collectively called INTERPHASE.







Homework

Assignment #1: Questions #1-5 + Getting to know the Cell Cycle
Complete this assignment in the space provided below.

1. What are the three main reasons that cells divide? GRR (grow, repair, replace)
2. What are the three stages of the cell cycle? Interphase, Mitosis, Cytokinesis
3. What phase of the cell cycle is the longest? Interphase
4. What happens to the DNA in S? Replicates / Doubles
5. What is the name of the protein that separates the DNA strands during DNA replication? Enzyme

Vocabulary	
anaphase	mitosis
cell cycle	nucleolus
cytokinesis	nucleus
DNA	prophase
duplicated chromosomes	telophase
four	three
interphase	two
metaphase	

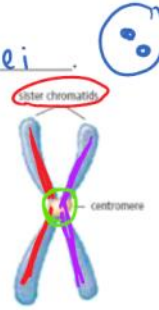
Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. There are THREE stages in the life of a cell.
2. The stage that makes up most of the cell's life is INTERPHASE.
During this stage, cells grow and carry out their life functions. In cells that will divide, the nucleus makes a copy of its DNA.
3. During MITOSIS, the nucleus of the cell divides into two equal and identical parts. Each part has a copy of the DNA. 
4. During CYTOKINESIS, the two equal, identical parts of the cell separate. This stage forms TWO identical cells with a nucleus and DNA. 
5. There are FOUR phases of mitosis.
6. In PROPHASE, the duplicated chromosomes contract into an X shape and the nucleolus OR nucleus disappears.
7. In METAPHASE, the duplicated chromosomes line up across the middle of the cell. 
8. In ANAPHASE, the duplicated chromosomes move apart to opposite ends of the cell. 
9. In TELOPHASE, a nucleus forms around the chromosomes at the opposite ends of the dividing cell.

The Cell Cycle – Mitosis

- **MITOSIS** is a type of nuclear division that, produces two identical nuclei.
- When cell division occurs there will be **TWO IDENTICAL CELLS!**
- As the nucleus prepares to divide, replicated DNA from interphase joins together to form Sister chromatid, which are joined by a centromere.
- Mitosis is used for growth, repair, replace old cells.
- Daughter cells are genetic duplicates of the parent cell.
- All body cells except sex cells reproduce this way.
- The stages are represented by **IPMAT**

PARENT
↓
DAUGHTER ↓
DAUGHTER



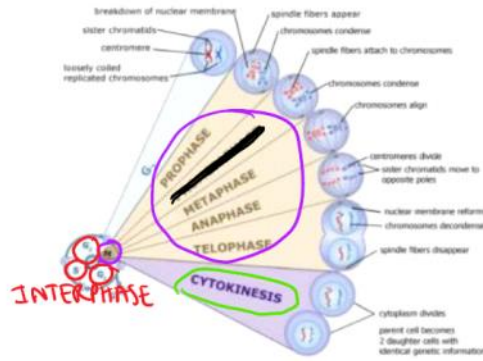
1. **Interphase (G₁, S, G₂)**
 2. **Prophase**
 3. **Metaphase**
 4. **Anaphase**
 5. **Telophase**
- } MITOSIS

- A way to remember this: **I Picked My Apples Today**

ORIGINAL CELL

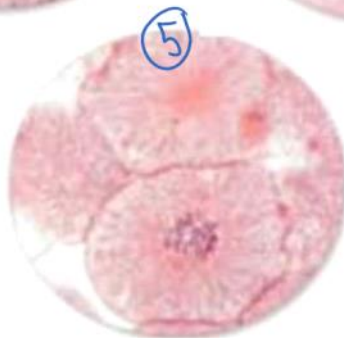
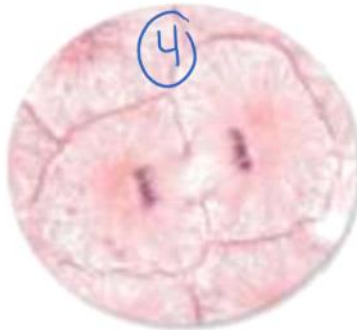


IDENTICAL DAUGHTER CELLS



PRACTICE

Order the following cells in the order that you think the stages of mitosis would occur.



The Stages of the Cell Cycle in More Detail:

Interphase

- Chromosomes replicate
- Centrioles replicate
- Chromosomes are NOT visible (DNA not visible)
- Nuclear membrane still visible
- Nucleolus still visible

Prophase

- Chromosomes condense and become more visible
- Chromatids pair up to form double-stranded chromosomes
- Nuclear membrane disappears
- Nucleolus disappears
- Spindle apparatus forms

Metaphase (Middle)

- Tetrads line up on cell equator
- Two separate centrioles begin to pull chromosomes apart

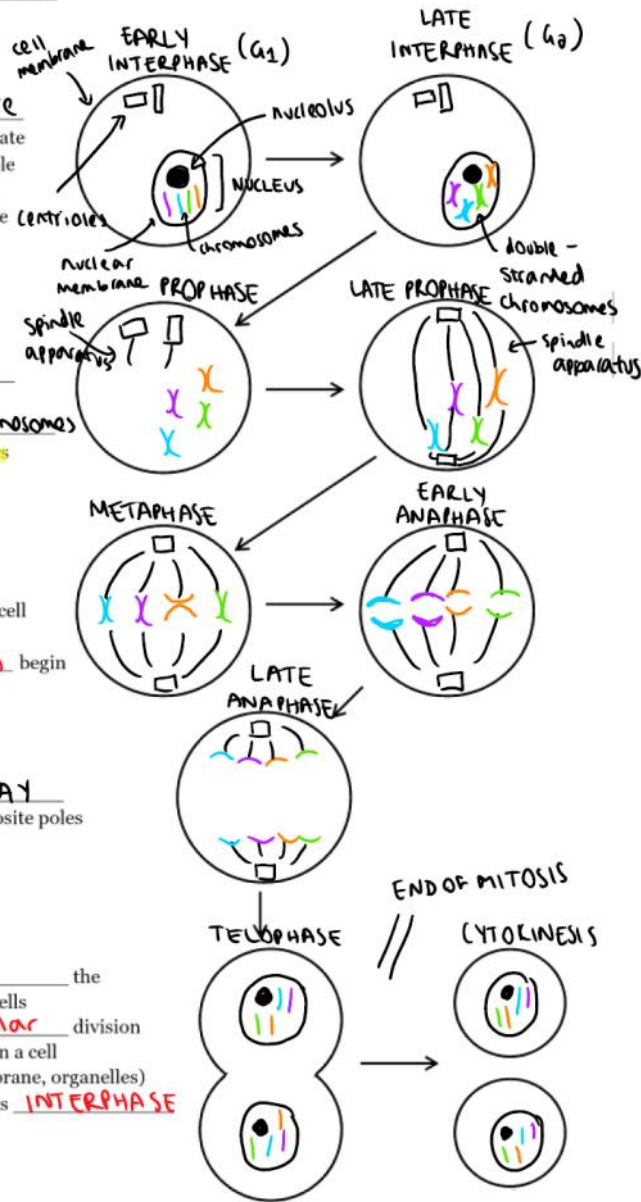
Anaphase (Away)

- Chromatids move away from each other towards opposite poles

Telophase

- Nuclear membrane reforms
- Nucleolus reappears
- Cell membrane splits the cells into 2 daughter cells
 - Cytokinesis: cellular division of all other materials in a cell (cytoplasm, cell membrane, organelles)
- End of mitosis, cell now enters INTERPHASE again

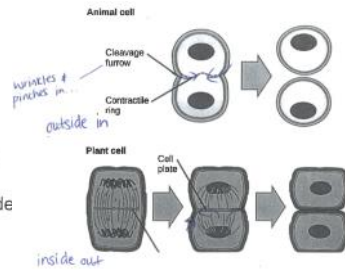
CYTOKINESIS



WHAT HAPPENS DURING CYTOKINESIS?

Cytokinesis is the division of the remaining organelles
and the cytoplasm.

What is the difference between how animal cells divide and how plant cells divide

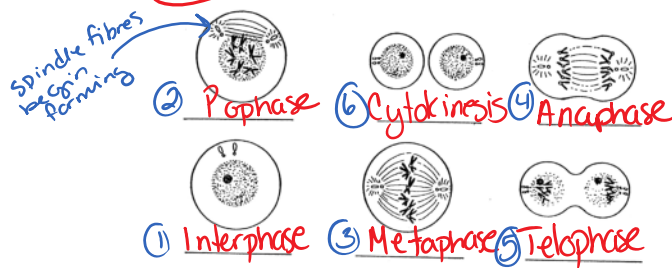


PRACTICE

Cell Cycle Stage	Chromosome Appearance and Location	Important Events
Interphase	DNA <u>doubles / duplicates / copies</u> itself	DNA replication Cell copies organelles
Prophase	Chromosomes <u>condense</u>	Nuclear membrane <u>disappears</u> Spindle fibers form
Metaphase	Chromosomes line up along the cell's <u>middle / equator / center</u>	<u>Centrioles / spindle fibers</u> connect to chromosomes
Anaphase	Chromosome copies <u>move away</u> and move apart	Spindle fibers pull chromosome copies <u>apart</u> to opposite poles
Telophase	Chromosomes <u>uncoil</u>	Nuclear membranes reform <u>centrioles / spindle apparatus</u> disappear
Cytokinesis	Chromosomes are uncoiled	<u>DIVISION.</u> of the rest of the cell - cytoplasm and organelles

PRACTICE

Number the following six diagrams of the stages of mitosis in Animal cell.
(animal or plant?) cells in the proper order. Label each stage with the name.





READING ABOUT: THE CELL CYCLE & MITOSIS P914-15

Complete the following reading about the nucleus.

Be sure to "Mark the Text" and highlight KEY DEFINITIONS as you read along.

ALSO, answer the "Reading Check" questions in the side margin as you go! ✓

The Cell Cycle and Mitosis

Before You Read

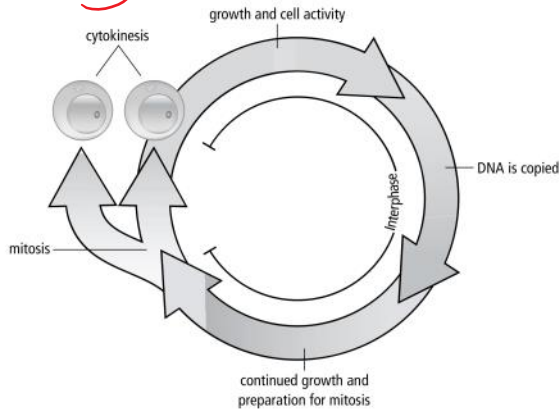
How do cells replace themselves? Record your ideas on the lines below.

_____ replicating / reproduction _____

Mark the Text

Create a Chart

Highlight the text that describes the three stages of the cell cycle. In a different colour, highlight text that describes how cells divide. Use the highlighted text to create a chart about the life of a cell.



What is the cell cycle?

The three stages of the life of a cell together are called the **cell cycle**. These three stages are:

- ◆ **interphase:** This stage makes up most of the life of the cell. During interphase, cells grow and carry out their life functions. In cells that will divide, the nucleus makes a copy of its DNA in a process called **replication**.
- ◆ **mitosis:** During this stage, the nucleus of the cell divides into two equal and identical parts. Each part has a copy of the DNA.
- ◆ **cytokinesis:** During this stage, the two equal, identical parts of the cell separate. The result of this stage is two identical cells, each with a nucleus and DNA. ✓





Reading Check

1. What are the three stages in the life of a cell?

1. interphase, mitosis, cytokinesis

What are the phases of mitosis?

There are four phases of mitosis. These phases are prophase, metaphase, anaphase, and telophase.

Phases of mitosis	What happens
prophase 	<ul style="list-style-type: none"> the duplicated chromosomes form into an X shape and the nucleolus disappears. spindle fibres, which are tiny tube-like structures made of protein, begin to form in plant and animal cells
metaphase 	<ul style="list-style-type: none"> the duplicated chromosomes line up across the middle of the cell
anaphase 	<ul style="list-style-type: none"> the duplicated chromosomes move apart to opposite ends of the cell
telophase 	<ul style="list-style-type: none"> a nucleolus forms around the chromosomes at the opposite ends of the dividing cell

How can mutagens affect the cell cycle?

Mutagens can cause changes in the cell cycle so that cells keep dividing continuously. The cells pile up on top of one another, forming a lump called a tumour. The uncontrolled cell division sometimes results in diseases called **cancers**. Cancerous cells may grow in one place in the body, or they may spread to other parts of the body where they will continue to divide. ✓

✓ Reading Check

2. What is cancer the result of?

2. uncontrolled cell division

Homework

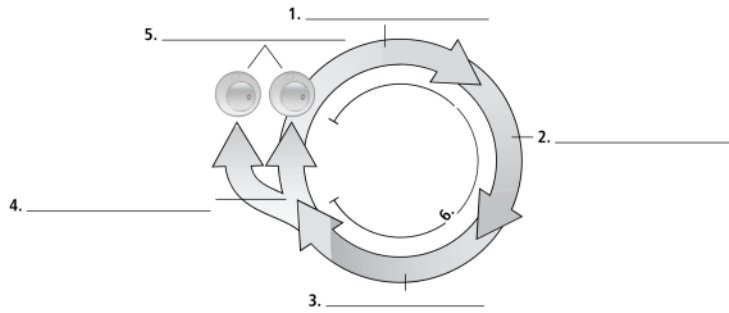
Assignment #2: Worksheets + Practice Questions pages 16-19
Complete this assignment in the space provided below.

Use the reading on the previous pages & your notes to answer the following questions

Identifying stages of the cell cycle

Vocabulary	
continued growth and preparation	growth and preparation
cytokinesis	interphase
replication	mitosis

Use the vocabulary words in the box above to label the stages of the cell cycle in the following diagram.







Briefly describe what is occurring in each stage of the cell cycle.

1. _____	Getting to know the cell cycle Page 70 1. three 2. interphase, DNA 3. mitosis 4. cytokinesis, two 5. four 6. prophase, nucleolus 7. metaphase, duplicated chromosomes 8. anaphase, duplicated chromosomes 9. telophase, nucleolus	_____
2. _____		_____
3. _____		_____
4. _____		_____
5. _____		_____
6. _____		_____

Mitosis

Summarize what is happening in the cell for each phase of mitosis. Then draw a labelled diagram of each phase.

Phase	What is happening in the cell?	Labelled diagram
prophase		
metaphase		
anaphase		
telophase		

PHASE	WHAT IS HAPPENING TO THE CELL?	LABELLED DIAGRAM
prophase	<ul style="list-style-type: none"> - The duplicated chromosomes form an X and the nucleolus disappears. - Spindle fibres, which are tiny tube-like structures made of protein, begin to form in plant and animal cells. 	
metaphase	<ul style="list-style-type: none"> - The duplicated chromosomes line up across the middle of the cell. 	
anaphase	<ul style="list-style-type: none"> - The duplicated chromosomes move apart to opposite ends of the cell. 	
telophase	<ul style="list-style-type: none"> - A nucleolus forms around the chromosomes at the opposite ends of the dividing cell. 	

Key

The cell cycle and mitosis

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. <u>E</u> cell cycle	A. first and longest stage of the cell cycle
2. <u>F</u> cytokinesis	B. process during which the cell copies DNA information in the nucleus
3. <u>A</u> interphase	C. result of uncontrolled cell division
4. <u>D</u> mitosis	D. process in which the duplicated contents of the cell's nucleus divide into two equal parts
5. <u>B</u> replication	E. three stages of the life of a cell
	F. final stage of the cell cycle, which separates the two nuclei and the cell contents into two identical cells

Circle the letter of the best answer.

6. Tiny tube-like structures made of protein are called

- A. spindle fibres
- B. chromosomes
- C. nucleolus
- D. DNA replication

7. Which stage is the longest in the cell cycle?

- A. interphase
- B. mitosis
- C. cytokinesis
- D. DNA replication

8. The phase of mitosis where the chromosomes line up across the middle of the cell is

- A. anaphase
- B. metaphase
- C. prophase
- D. telophase

9. The phase of mitosis in which the duplicated chromosomes form into an X shape is

- A. anaphase
- B. metaphase
- C. prophase
- D. telophase

10. The phase of mitosis in which duplicated chromosomes move apart to opposite ends of the cell is

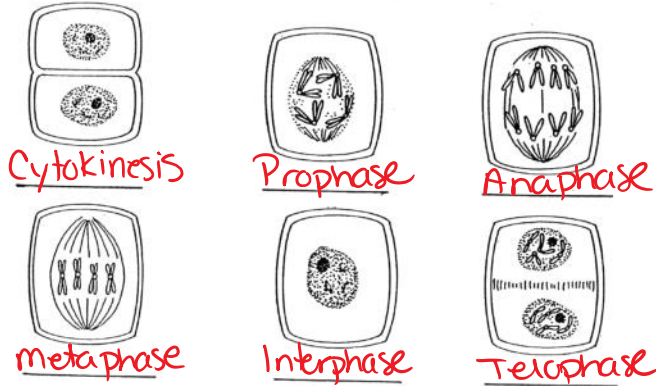
- A. anaphase
- B. metaphase
- C. prophase
- D. telophase

11. The phase of mitosis in which a nucleolus forms around the chromosomes is

- A. anaphase
- B. metaphase
- C. prophase
- D. telophase

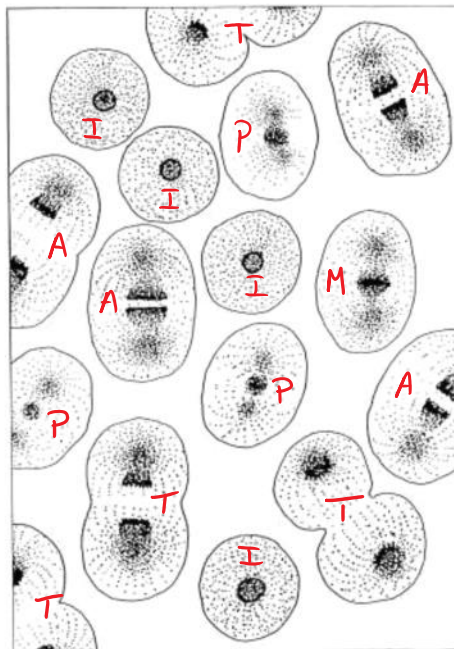


Number the following six diagrams of the stages of mitosis in Plant (animal or plant?) cells in the proper order. Label each stage with the name.



Label each cell with its stage of the cell cycle/mitosis:

- I = interphase
- P = prophase
- M = metaphase
- A = anaphase
- T = telophase
- C = cytokinesis



19

HW: Thursday June 6th
 • complete all assignments + "practice" questions up to p. 20



Viewing Mitosis Lab Activity

Viewing Mitosis Activity

Introduction: Throughout this activity we will be examining different cells to gain a better understanding of the process involved in cell division.

Part 1. Micro-Slide-Viewer and Plant Mitosis

Read and follow the directions for the use of the Micro-Slide-Viewer on the envelope holding the slides.

Examine each slide and study the description in the text folder. After studying each slide and the printed text, answer the question for that slide on this worksheet.

Plant Mitosis (Background Information on Front Cover)

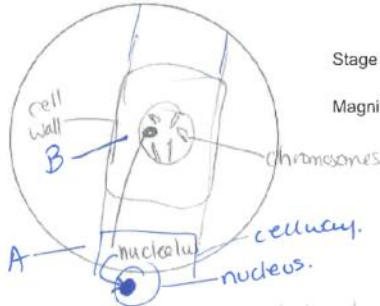
1. Why do new plants, formed by cuttings from older plants, end up just like the parent plant?

Plant Mitosis (Background Information on Front Cover)

- P₂ a. Why do new plants, formed by cuttings from older plants, end up just like the parent plant?
 → in each cell there is a mechanism that operates to maintain a hereditary pattern from 1 cell → daughter cell (cell division)
- ↑ P₃ b. Another name for cell division is mitosis.

Slide 1 – Early Prophase

1a. Draw a cell that illustrates the beginning of mitosis in the circle below, as seen in Slide 1. Label any parts of the cell that you can clearly identify.

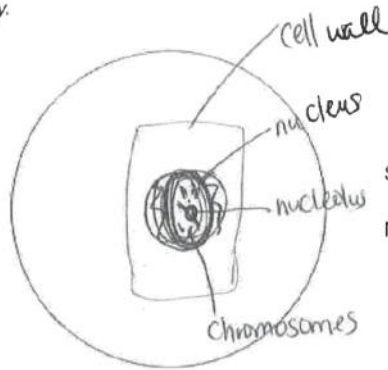


Stage of Mitosis: Early Prophase
 Magnification: 5000x (5 x 1000 = 5000x)

- 1b. Another term for the "resting phase" is interphase. Why isn't 'resting' an accurate description of this phase? chromosomes already be to duph
- 1c. At what stage do the chromosomes duplicate themselves? interphase
- 1d. At what stage does mitosis begin? prophase

Slide 2 – Prophase

2a. Draw the large cell near the center of the slide. Label any parts of the cell that you can clearly identify.



Stage of Mitosis: Prophase

Magnification: 5000x

2b. What has happened to the chromosomes at this stage?

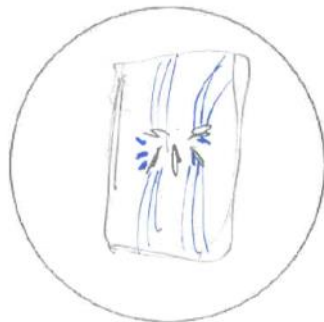
Have become thicker & shorter

2c. Compare this slide 2 with slide 1. What is happening to the shape of the nucleus?

Went from a more circular shape to an oval shape → breaking apart. (nuclear envelope/membrane dissolving).

Slide 3 – Metaphase

3a. Draw what you see on this slide in cell C. Label any parts of the cell that you can clearly identify.



Stage of Mitosis: Metaphase

Magnification: 5000x

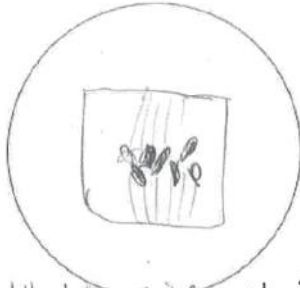
3b. The chromosomes line up in the middle of the cell at place called the equatorial plate.

Slide 4 – Early Anaphase

4a. What has happened to the chromosomes?

each chromosome has doubled/lined up at middle/
starting to separate

4b. Draw the cell at D. Label a pair of separating chromosomes.



Stage of Mitosis: Early Anaphase

Magnification: 5000x

★ Add 4c. What is visible at S? spindle fibers
 Slide 5 – Anaphase
 What is the function of S? pull chromosomes
 ↓
pole

5a. At what stage is cell E? Anaphase

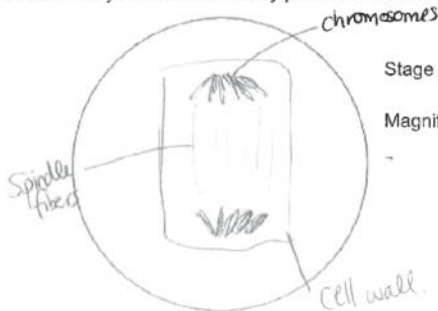
5b. At what stage is cell B? Prophase

↳ yes, all of them ... see dark nucleoli + small granules of chromatin.

5c. How many sets of chromosomes are visible at cell E? 2 sets.
 (has been duplicated, beginning to separate).

Slide 6 – Late Anaphase

6a. Draw cell F as you see it. Label any parts of the cell that you can clearly identify.



Stage of Mitosis: Late Anaphase

Magnification: 5000x

★ 6b. How does stage F differ from stage E (on slide 5)

F is further along in the process
 as chromosomes are further apart compared to E.

Slide 7 – Telophase

7a. What does the horizontal line through the middle of cell G represent?

separate when it will / Cell wall forms (secreted from each new cell)

7b. Compare the cell at the extreme upper right side of slide 2 with cell G. Describe what you see.

Some slides have this & some don't.

Look similar

Cell G has a thicker cell wall forming.

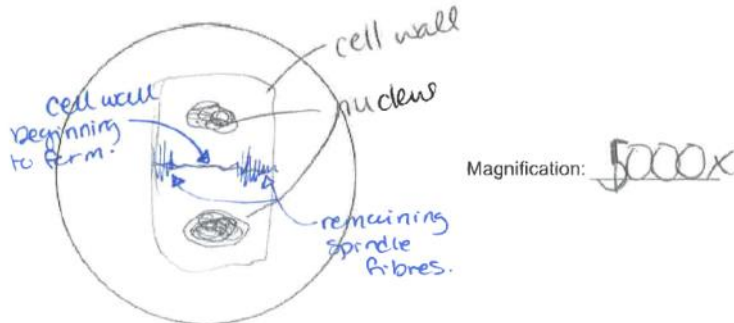
7c. Which is further advanced in the cell cycle, the cell on the upper right of slide 2 or cell G. How do you know?

The cell in slide 2 appears to be condensing into 2 nuclei... suggests it is further along than cell G (slide 7).

Slide 8 – Late Telophase

8a. At what stage is cell H? Late telophase → cytokinesis

8b. Draw cell H as you see it. Label any parts of the cell that you can clearly identify.

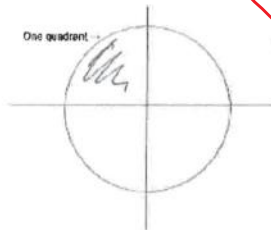


8c. If the original cell A contained 16 chromosomes, the number of chromosomes found in each daughter cell labeled H will be 16.

Part 2. Allium Root Tip Mitosis and the Microscope

Use a microscope to view the prepared slide of the allium (onion) root tip. Be sure to focus the slide using the 4x objective lens first, then the 10x objective lens and finally the 40x objective lens.

Once you have the slide focused using the 40x objective lens, count the total number of cells in one quadrant of the field of view. Then count the number of cells in the same quadrant that are undergoing cell division



First Count

Total Number of Cells: _____

Number of Cells Undergoing Cell Division: _____

Percent of Cells Undergoing Cell Division: _____

(go over how to calc %)

Move the slide around and make another count of a different quadrant in the field of view.

Second Count

Total Number of Cells: _____

Number of Cells Undergoing Cell Division: _____

Percent of Cells Undergoing Cell Division: _____

Part 3. Micro-Slide-Viewer and Animal Mitosis

Read and follow the directions for the use of the Micro Slide Viewer on the envelope holding the slides.

Examine each slide and study the description in the text folder. After studying each slide and the printed text, answer the question for that slide on this worksheet.

Animal Mitosis (Background Information on Front Cover)

a. What is an ascaris? a parasitic worm

(viewing egg sac)

b. Why is the ascaris a good specimen to use for this investigation?

chromosomes are large & } "simple"
the chromosomes only 4 of them.

Slide 1 - The Zygote

1a. What is a zygote?

a fertilized egg.

1b. How many masses of chromatin do you see in the cell?

2 masses

1c. Where did these masses come from?

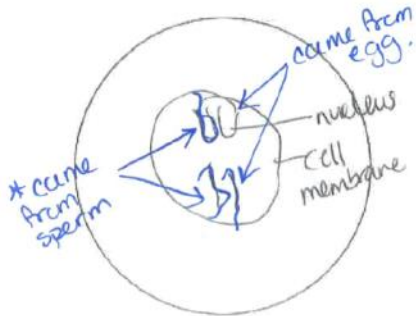
1 - nucleus of egg 1 - nucleus of sperm.

1d. The amount of hereditary material supplied by each parent of the ascaris is (choose one):

Equal Not Equal

Slide 2 - Pro-Metaphase

2a. Draw what you see in the slide. Label all identifiable structures



Magnification: $\frac{3750x}{(750x \cdot 5x)}$

2b. How many chromosomes can you see?

4

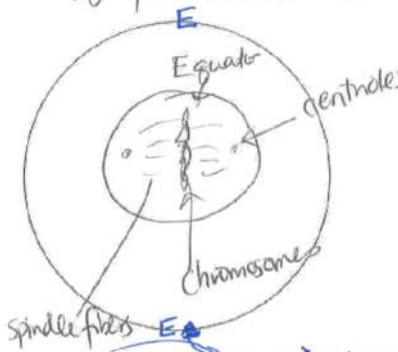
2c. Each parent supplied 2 chromosomes to form the zygote.

~~Use an asterisk (*) to label the chromosomes supplied by the sperm~~

← remove.

Slide 3 - Metaphase

3a. Draw what you see in the slide. Label the equator, the centrioles, the chromosomes, and a spindle fibre. *(if you can see them)*



Magnification: 3750X

Slide 4 - Metaphase (Polar view)

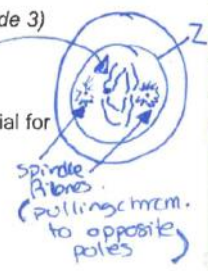
4a. How does this picture differ from that in slide 3?

view from "pole to pole" along Equatorial Plate
less lined up along equator (looking from side)
shows 4 separate chromosomes + centromeres more clearly

Slide 5 - Early Anaphase

5a. How many chromosomes are ^{shown} showing in this slide? (Hint: Compare with slide 3)

~~8 chromosomes~~ 8 chromosomes



5b. The number of chromosomes in this slide contains enough hereditary material for 2 cells.

Slide 6 - Anaphase

6a. The chromosomes in this slide have separated to form two groups

6b. Each group contains 4 chromosomes.

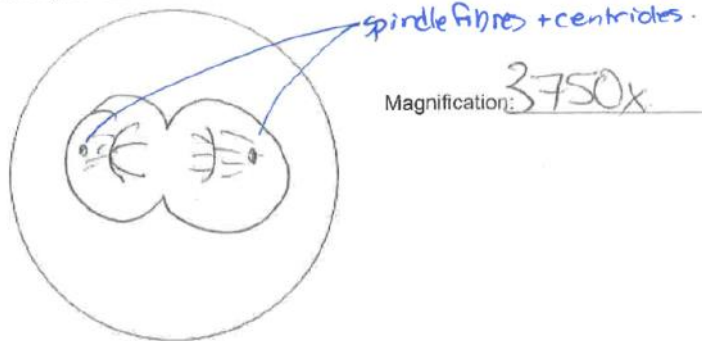
6c. Why do some of the chromosomes appear to be beaded in places?

result of loosening coil

Chromosome coils => short + thick bc of a tight twisted coil

Slide 7: Telophase

7a. Draw what you see in the slide. Label all identifiable structures.



7b. The two groups of chromosomes are: (Choose one)

Still connected

Completely apart from each other

7c. What is happening to the cell membrane?

Furrowing - pinches **inwards** and the cytoplasm is dividing into 2 masses.

Slide 8: Late Telophase

8a. How many cells are seen in this slide?

2 (daughter cells)

8b. How do these cells compare to the cell in slide 1?

same, just 2 now instead of 1.

8c. How many chromosomes are involved in human mitosis?

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Analysis Questions

1. How does telophase in plant cells differ from telophase in animal cells?

- in plants a cell wall is forming.
- in animal cells centrioles + spindle fibres pull chromosomes apart.

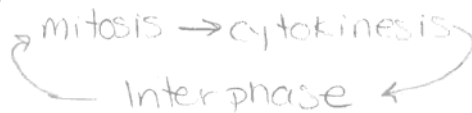
2. Explain why telophase in plants and animals is different (think in terms of a cellular structure they do not share).

- plants have a cell wall
- animals

3. How do the two new cells created during mitosis compare to the original parent cell?

The new cells are genetically identical to the parent cell.

4. What happens to the cells after mitosis takes place? (What phase does it go back into?)



5. What are some situations in which cell division would take place in an organism?

growth, repair, reproduction.

6. What is occurring inside the cell during interphase that cannot be seen by looking at the slide? Why is this event important to the cell preparing to divide?

the duplication of chromosomes.

7. Think back to what you saw with the microscope and the slide of the allium (onion) root tip ^(cell skitten) and the counts you made in Part 2. Do cells spend more of their lifecycle dividing or more of their life cycle in interphase?

cells spend about 90% of their lifecycle in interphase.



When Cell Division Goes Wrong ...

- DNA controls all cell activities including cell DIVISION
- Some cells lose their ability to CONTROL their rate of cell division – the DNA of these cells has become mutated
- These super-dividing cells form masses called tumours
 - Benign tumors are not cancerous – these cells do not spread to other parts of the body
 - Malignant tumors are cancerous – these cells can break loose and can invade and destroy healthy tissue in other parts of the body (called metastasis)
- Cancer is not just one disease, but many diseases – there are over 100 different types of cancers.
- Chemotherapy, radiation and surgery can often be used to eliminate cancer from the body.

PRACTICE

Take your best guess at this cancer true/false quiz. You can answer T, F or T & F.

- F Cancer can be caused by contact with an afflicted person.
- F Most tumours (irregular growth) lead to cancer.
- T Cancer more frequently attacks middle-aged and older people than younger people.
- T Lung cancer is one of the most difficult cancers to cure, and is fatal in 84% of cases.
- T Lung cancer deaths are more common among cigarette smokers.
- T A wart is a benign (non-spreading) tumour.
- T&F Children of parents who have died from cancer are more likely to develop the disease.
- T&F Blood in urine is a sign of cancer.
- T A sore that does not heal is a cancer danger signal.
- T Certain dyes, used to colour food, can cause cancer.
- F Once you have survived a cancer, you develop an immunity to that type of cancer.

//

Asexual Reproduction



- Asexual reproduction requires only ONE parent
- The process in which one cell divides to form two, smaller, identical cells. These cells can then grow in size.
- Examples of organisms that reproduce using asexual reproduction:
 - Bacteria
 - Some plants
 - Yeast

REPRODUCTION TRANSFERS GENETIC INFORMATION FROM PARENTS TO OFFSPRING

Every species has its own strategies for reproduction.



We will watch a few clips to get a sense of some of the variety of strategies for **birds, plants and planarians**.

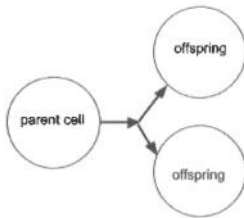
As we watch try to compare how the strategies are similar and how they are different:

Similarities

Differences

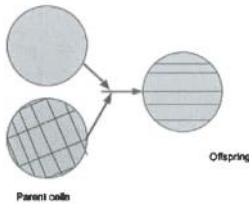
There are two basic ways that living things reproduce: through asexual or sexual reproduction.

Asexual Reproduction



- offspring come from a single parent
- each offspring receives an exact copy of the parent's DNA
- offspring genetically identical to parent & each other

Sexual Reproduction



- two parents, each contributes half of offspring's genetic material
- offspring aren't identical to parents & each other (in most cases)

In both **asexual** and **sexual** reproduction the genetic material is passed on to the offspring. This information is contained within the DNA.



Amoeba Sisters: Asexual & Sexual Reproduction
<https://www.youtube.com/watch?v=fcGDUcGjcyk>



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Bird of Paradise Courtship:
<https://www.youtube.com/watch?v=nWfyw51DQfU>

Pollen Grains: 1:00 - 4:50
<https://www.dailymotion.com/video/x218rha>

Planarians:
<https://youtu.be/m12xsf5g3Bo>



Amoeba Sisters Video Recap: **Asexual and Sexual Reproduction** ANSWER KEY

A Comparison of Reproduction Types

What could you infer about these spider plantlets based on the video and graphic shown below? Please place a checkmark next to any statements that would be correct for the graphic represented below.

- 1. All of the plantlets are identical to the parent plant.
- 2. All of the plantlets are identical to each other.
- 3. The plantlets have a different **genetic code** from the parent plant.
- 4. This represents **asexual reproduction**.
- 5. This specific process involves **gametes**.
- 6. The plantlets are the same size as the parent plant.
- 7. This specific process involves a male and female plant.
- 8. The plantlets are **uniform**.
- 9. There is **genetic variation** among the plantlets.
- 10. Each plantlet is a **clone** of the parent plant.
- 11. This represents **sexual reproduction**.
- 12. This type of reproduction also includes **binary fission** and **budding**.
- 13. This requires two organisms to produce offspring.
- 14. This requires only one organism to produce offspring.
- 15. The **DNA** would be the same in the parent plant and offspring.
- 16. **Fertilization** occurs in this type of reproduction.



17. What are some advantages of **asexual reproduction** when compared to **sexual reproduction**? What are some disadvantages of **asexual reproduction** when compared to **sexual reproduction**?

Asexual reproduction only requires one individual so the gametes of two different organisms will not have to reach each other to unite. Asexual reproduction therefore has the potential to be faster and more efficient.
Asexual reproduction has a disadvantage of not resulting in genetic variety which can mean a disadvantage in offspring survival in the case of a change (such as an environmental change).



PLANTS

In sexual reproduction in plants, male and female gametes unite to produce a new organism. Pollen is the male gamete in flowering plants and the egg or ovum is the female gamete.

Labels: stamens, pollen, style, ovary, fertilization.

Male gametes and female gametes contain half the usual number of chromosomes (genes). During fertilization, the two fuse to form a zygote - a fertilized egg.

Can be internal or external

Labels: Sperm, Egg, Fertilization, Zygote.

Sexual reproduction occurs when two parents mix genes in order to produce offspring that are not identical.

SEXUAL REPRODUCTION

ADVANTAGES!

- only need one parent
- produce more offspring quickly
- occurs simply

DISADVANTAGES!

- No genetic variation
- bad characteristics passed on
- difficult for organisms to adapt

ADVANTAGES!

- high genetic variation
- organisms are able to adapt over time
- Not all bad genes are passed on

DISADVANTAGES!

- requires parental courtship and mating
- smaller population produced
- can be complicated!

ASEXUAL REPRODUCTION

Asexual reproduction occurs when one parent makes an exact copy of itself - a clone!!

BUDDING

Budding occurs when a second organism develops from an outgrowth of the original.

Labels: Hydra.

FISSION

A type of cell division that results in two identical organisms.

Labels: AMOEBAS.

FRAGMENTATION

A piece or fragment of an animal develops into a full grown copy.

Labels: STARFISH.

SPORES

Organisms such as fungi release spores (tiny balls of cells) that can grow into new identical organisms.

VEGETATIVE PROPAGATION

Some plants can send out runners that sprout identical daughter plants.

Labels: STRAWBERRY PLANT.

PARTHENOGENESIS

In rare cases, some animals can give birth to young despite not mating.

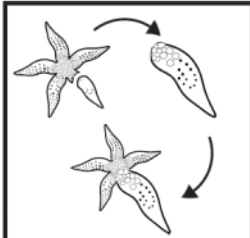
Labels: SNAKES, SHARKS.

SHOW what you KNOW REPRODUCTION

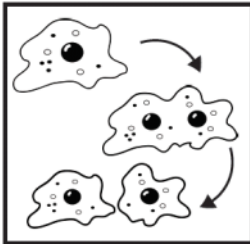
Name:

Date:

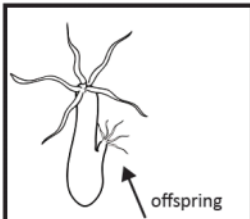
1. Identify each type of asexual reproduction



A: fragmentation



B: fission



C: budding

2. Name one advantage and one disadvantage for sexual and asexual reproduction.

sexual reproduction advantage:

answers will vary

sexual reproduction disadvantage:

answers will vary

asexual reproduction advantage:

answers will vary

asexual disadvantage:

answers will vary



Fill in the blank with the correct term.

3. Male and female reproductive cells are collectively known as gametes.

4. Genetically identical offspring are clones of the parent organism.

5. fertilization occurs when a male gamete (sperm) combines with a female gamete (egg).



Answer the following questions.

7. In fission, how does the DNA of the daughter cells compare to the DNA of the parent cell?

The DNA is exactly the same.

8. How many parents are required for sexual reproduction?

two parents

9. If a sex cell has 8 chromosomes, how many chromosomes will there be after fertilization?

16 chromosomes, 8 from one parent and 8 from the other

Asexual Reproduction - one parent - offspring is an exact copy
 - primary form of reproduction for single celled organisms like mold & bacteria

Advantages: "gametes"

- faster process (no making of egg/sperm)
- requires less energy - produces lots of offspring.
- don't need a partner - good if population is low

Disadvantages:

- offspring are genetically identical less variety, more susceptible to Δs in environment
- produces lots of offspring → competition for resources w/in own species.



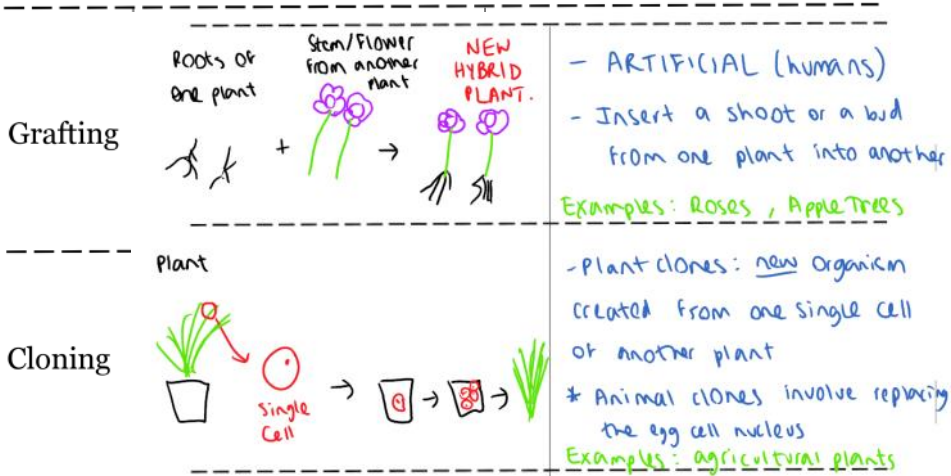
Types of Asexual Reproduction Station Notes

At the lab benches are explanations and examples of different types of asexual reproduction. As you visit each station complete the chart below:

Type of asexual reproduction	What organisms use it?	How does it happen? Describe the process.	Make a simple drawing to illustrate the process.
Binary fission	bacteria protists	cell copies its contents & then splits in 2	
Budding	yeast hydra	parent produces smaller version of self → detaches	

Type of asexual reproduction	What organisms use it?	How does it happen? Describe the process.	Make a simple drawing to illustrate the process.
Spore formation (<u>sporogenesis</u>)	Ferns, mold, fungi, algae.	cells produced (spores) similar to seeds.	
Fragmentation (<u>regeneration</u>)	worms starfish	new organism grows from a fragment of parent.	
Vegetative Reproduction -Rhizomes and Tubers	grasses cattails sedges.	stems grow under soil & a new plant grows from them.	
Vegetative Reproduction -Runners	straw berry	stems grow under soil & a new plant grows from	
Vegetative Reproduction -Plantlets	Kalanchoe spider plant	miniature plants grow at end of leaves & eventually become separate	

Last couple Types of Asexual Reproduction



READING ABOUT ASEXUAL REPRODUCTION P936-37

Complete the following reading about the nucleus.
Be sure to "Mark the Text" and highlight KEY DEFINITIONS as you read along.

ALSO, answer the "Reading Check" questions in the side margin as you go! ✓

Asexual Reproduction

Before You Read

What kinds of organisms reproduce by making exact copies of the parent organism? Give three or four examples on the lines below.

bacteria, yeast, hydra, fungi, algal, etc

What is asexual reproduction?

Asexual reproduction is the formation of a new individual that has the same genetic information as its parent. The individual is a clone, or an exact copy, of its parent. Asexual reproduction occurs in one-celled organisms such as bacteria and in multicellular organisms such as plants.

What types of asexual reproduction are there?

There are several types of asexual reproduction, as shown in the table below.

Type of asexual reproduction	Definition	Examples of organisms that use this form of reproduction
binary fission	the splitting of a single parent cell into two equal parts that have the same copies of genetic material	<ul style="list-style-type: none"> • some kinds of bacteria • amoeba
budding	a group of rapidly dividing cells develops on an organism and breaks away to become a new organism	<ul style="list-style-type: none"> • some simple multicellular organisms such as hydras and sponges • one-celled yeasts
fragmentation	a small piece of an organism breaks away from it and develops into a new individual	<ul style="list-style-type: none"> • some plants, such as mosses and liverworts • some animals, such as some sea stars and corals
spore formation	parent organism produces spores: single cells that can develop into new individuals by repeated mitosis	<ul style="list-style-type: none"> • common in fungi • some plants and algae
vegetative reproduction	special cells, usually in the stems and roots of plants, divide repeatedly to form structures that develop into a plant that is identical to the parent	<ul style="list-style-type: none"> • very common in most kinds of plants

What are the advantages and disadvantages of asexual reproduction?

Advantages of asexual reproduction include:

- ◆ large colonies can out-compete other organisms for nutrients and water
- ◆ large numbers of offspring reproduce very quickly species can
- ◆ survive if the number of predators increases

Disadvantages of asexual reproduction include:

- ◆ offspring compete for food and space
- ◆ extreme temperatures can wipe out entire colonies
- ◆ negative mutations can destroy many offspring

✓ Reading Check

1. What is one advantage of asexual reproduction?

1. Any of: can out-compete other organisms, reproduce quickly, and can survive if predators increase.

What technologies make use of asexual reproduction?

Humans can help other organisms reproduce asexually. This may be done to preserve the DNA of an organism. It may also be done to make large numbers of a particular type of organism that has a useful trait.

Growing new plants from the cut ends of plant stems and roots is one way that humans make clones of plants. Making clones of animals involves taking the nucleus from one type of cell and putting it into an egg cell that has had its nucleus removed. As the egg cell divides, its new cells have the DNA from the first type of cell.

Researchers are now using stem cells in cloning research. **Stem cells** are cells that can divide to form one of many different types of cells. Stem cells that come from human embryos can become any of the 200 types of cells in the human body. Stem cells that come from specific body tissues can become only a few types of body cells. Doctors are working to use stem cells to treat certain disorders such as diabetes and cancer. ✓

✓ Reading Check

2. What are stem cells?

2. cells that usually divide to form one of many different types of cells



Types of asexual reproduction

Vocabulary	
asexual reproduction	fragmentation
binary fission	grafts
budding	spore formation
clone	stem cells
cuttings	vegetative reproduction
DNA	

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. A clone is an identical genetic copy of its parent.
2. In asexual reproduction, only one parent is required to produce offspring.
3. Binary fission is a method of reproduction for some types of bacteria.
4. Some simple organisms, such as hydras and sponges, are able to reproduce asexually by budding.
5. Certain species of sea stars, corals, and mosses can reproduce asexually by fragmentation.
6. vegetative reproduction occurs when special cells in the stems and roots divide repeatedly to form structures that eventually develop into a plant identical to the parent.
7. Some bacteria can reproduce asexually when their single cells split in two, forming new individuals in a process called spore formation.
8. Human-assisted cloning can be used to save the DNA of an organism or mass produce an organism with a desired trait.
9. stem cells are cells that have the potential to become many different types of cells.

True or false?

Read the statements given below. If the statement is true, write "T" on the line in front of the statement. If it is false, write "F" and then rewrite the statement to make it true.

1. F Asexual reproduction is the formation of a new individual that has ~~different~~ genetic information from its parent. *The same*

2. F Asexual reproduction occurs in ~~multicellular~~ *one-celled* organisms such as bacteria and in ~~one-celled~~ *multicellular* organisms such as plants.

3. T Sometimes humans help other organisms reproduce asexually in order to preserve the DNA of an organism.

4. T Sometimes humans help other organisms reproduce asexually to make large numbers of a particular type of organism that has a useful trait.

5. F Growing new plants from the cut ends of ~~flowers~~ *stems & roots* is one way that humans make clones of plants.

6. F Making clones of animals involves taking the nucleus from one type of cell and putting it in the ~~nucleus of another type of cell.~~ *egg cell that has had its nucleus removed.*

Asexual reproduction

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. <u>G</u> asexual reproduction	A. reproductive cells that develop into new individuals by repeated mitosis
2. <u>D</u> binary fission	B. a group of rapidly dividing cells develops on an organism and breaks away to become a new organism
3. <u>B</u> budding	C. a form of asexual reproduction in which each fragment of an organism develops into a clone of its parent
4. <u>E</u> clone	D. single parent cell splits into two equal parts that have the same copies of genetic material
5. <u>C</u> fragmentation	E. an identical genetic copy of an organism's parent
6. <u>A</u> spores	F. only found in human embryos
7. <u>H</u> vegetative reproduction	G. reproduction that requires only one parent
	H. root cells divide repeatedly to form structures that develop into a plant that is identical to the parent

Circle the letter of the best answer.

8. Asexual reproduction requires

- A. only one parent to produce offspring
- B. two parents to produce offspring
- C. a combination of parents to produce offspring
- D. two clones to produce offspring

9. Bacteria reproduce asexually by

- A. budding
- B. fragmentation
- C. binary fission
- D. cloning

10. Stem cells have the potential to

- A. divide rapidly
- B. increase the amount of DNA
- C. become many different types of cells
- D. invade other types of cells

11. During the process of cloning, scientists

- A. add more DNA to the parent cell
- B. remove the nucleus from an egg cell
- C. remove cytoplasm from an egg cell
- D. allow the egg cells to bud

12. One of the key advantages of asexual reproduction is

- A. offspring compete for food and space
- B. large numbers of offspring reproduce quickly
- C. extreme temperatures can wipe out entire colonies
- D. offspring are genetic clones

13. One of the disadvantages of asexual reproduction is

- A. species cannot survive when predators increase
- B. large colonies can out-compete other organisms for nutrients and water
- C. large numbers of offspring reproduce very slowly
- D. extreme temperatures can wipe out entire colonies