

Unit Overview

Course: Biology

Grade Level: 9th

Unit Title: Basics of Cell Reproduction

Length of Time: 3 50m Class Sessions

Relevance: How do we grow, how do we heal?

Standards:

- Goal 1 Skills and Processes for Biology Assessment: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.
- Goal 3 Concepts of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. (NT, NTB = Not Tested)

Culminating Performance/Product: Collaborative poster formed from expert-home groups identifying the multiple stages of mitosis.

Lessons:

- Lesson 1
 - Introduction to Mitosis
- Lesson 2
 - Expert group work on mitosis stage
- Lesson 3
 - Home group work on mitosis posters

Lesson 1

Time Allotted: One period (50m)

Lesson Topic: Introduction to mitosis

Standards:

- Expectation 1.2
 - The student will pose scientific questions and suggest investigative approaches to provide answers to questions.
 - Indicator 1.2.1
 - The student will identify meaningful, answerable scientific questions.
 - Indicator 1.2.2
 - The student will pose meaningful, answerable scientific questions.(NTB)
 - Indicator 1.2.3
 - The student will formulate a working hypothesis.
- Expectation 1.4
 - The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication.
 - Indicator 1.4.2
 - The student will analyze data to make predictions, decisions, or draw conclusions.
 - Indicator 1.4.8
 - The student will use models and computer simulations to extend his/her understanding of scientific concepts.(NTB)
 - Indicator 1.4.9
 - The student will use analyzed data to confirm, modify, or reject a hypothesis.
- Expectation 1.5: The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.
 - Indicator 1.5.2
 - The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.
 - Indicator 1.5.5
 - The student will create and/or interpret graphics. (Scale drawings, photographs, digital images, etc.)
 - Indicator 1.5.6
 - The student will read a technical selection and interpret it appropriately.
 - Indicator 1.5.8

- The student will describe similarities and differences when explaining concepts and/or principles.
- Indicator 1.5.9
 - The student will communicate conclusions derived through a synthesis of ideas.

Cognitive/Affective Objectives:

- Students will gain experience interpreting scientific images
- Students will practice prediction and hypotheses development
- Students will work effectively with peers
- Students will develop their cognitive reasoning

Materials:

- Teacher Needed:
 - Projector
 - PC
 - OneNote Mitosis Lesson Plan 1 Daily Objectives
 - Worksheet 1
 - Mitosis Homework 1
 - Expert Group Assignment Slide
- Student Needed:
 - Pencil
 - Journal
 - Notepaper
 - Worksheet 1
 - Homework 1

Warm-up: (6m)

- Pre-bell
 - Address student questions, identify students that missed previous lesson(s) and speak with them.
 - Prepare class materials/projector with daily question
- Post bell (6m)
 - Present students with question of the day for their journal (based on previous lesson).
 - Take attendance
 - Distribute bridge exercise (Worksheet 1)
 - Collect previous homework

Motivator/Bridge: - Tied into Developmental Activity for lesson (4m)

- Review Prior learning:
 - Reflection on warmup question (4m)

- Use of daily warmup question pertaining to previous lesson. As this is a new unit, no previous knowledge to be reviewed.
- Prior-Knowledge
 - First activity requires no introduction of mitosis material
 - First activity will utilize prior knowledge to analyze images of mitosis stages and place them in an order.
- Goal-Objective
 - Become introduced to visual representation of the stages of mitosis
 - Review and learn pertinent vocabulary
 - Gain an introduction to unit group project

Developmental Activity: (30m)

- Describe worksheet task – 6 minutes:
 - Do not explain what is on the sheet (Don't identify as cells)
 - Students may recognize them, don't acknowledge as positive or negative.
 - Explain that it's not necessary to know what they are looking at
 - Coach students to use any reasoning they want to order the pictures 1-15
 - Announce that they will have 8 minutes to order the pictures
 - Reinforce that it is not graded and that they should not agonize over their decisions
 - Have students use a pencil for easy adjustments
 - Reinforce that it is an individual task
 - Ask for questions/respond to questions
- Initiate worksheet Task – 8 minutes , start timer
 - Observe students while completing task.
 - Note early completion
 - Note loss of focus
 - Note struggling students
- Conclusion of Task – 15 Minutes
 - Query students through the use of clickers as to the order of each cell
 - Tally results for each cell
 - A “class” order will then be created on the board.
 - Inquire for general reasoning behind ordering, record reasons.
- Student Activity:
 - Individual completion of Worksheet 1
 - Use of clicker response during conclusion to poll responses for each individual picture.
- Materials:
 - Student: Writing tool, clicker
 - Teacher: Worksheet 1, clicker response software, PC, Timer, Projector
- Inspired by Mitosis Sequencing Activity (Shields, 2006, pp. 98-102)

Assessment:

Observation of students while working on Worksheet 1, noting students that complete early, lose focus, or appear to be struggling to complete assignment. During conclusion of task students will respond with the order they chose for Worksheet 1 using clicker technology which will provide classroom metrics. This will allow me to assess prior knowledge as well as student ability to reason.

Summary/Closure:

- Give a brief overview of lesson 2/3 group assignment and poster project.
- Review Homework Assignment
- Respond to student questions

Review/Reinforcement:

- Homework sheet take home: Parts of the Cell
 - Homework will review prior vocabulary on cell structure needed for unit.

Adaptation:

- Additional vocabulary worksheets can be provided
- Students that may need more time to complete ordering assignment can continue to work on it at home.
- Classroom discussion can be summarized and provided to students

Reflection:

Students begin their exploration of mitosis from a self-guided aspect. The use of the exercise was two-fold. First, it presented students with an opportunity to draw from one or more of their multiple intelligences to complete the assignment ("Tap. in. Mult. Int.: Imp.," 2004). Inclusion of graphics based instruction allows for greater differentiation within the classroom while reducing the need for more specific IEP development. Students across the spectrum, from sensory (those that prefer facts and memorization) to intuitive (those that prefer concepts and the relationship of information) are able to benefit from visual learning (Tanner & Allen, 2004, p. 199). As the assignment was not graded students were not pressured to "get the right answers" and would be more likely to apply a variety of strategies in ordering the stages. Secondly, I feel that by opening with this exercise students become invested in learning the material as they have a natural curiosity to understand what they are looking at. Snowman refers to this as "learning by discovery"(2011, p. 458). The use of clicker technology to tally answers has multiple benefits. First, it allows me to quickly collect data from the classroom. Secondly, it allows students to be honest in their response as they won't be concerned with classmate perception of a right or wrong answer (2011, p. 500). Third, the quick access to response data can be used by me to generate a class created version of the worksheet without any excessive loss of class time. This exercise can then be repeated after the unit is completed. A comparison of right/wrong answers can give easy to calculate quantitative data that I can use to assess the comprehension of the topic. I should also mention that by using visual media and clicker technology, it allows this

exercise to be easily accessible by students with reading comprehension, physical, or social disabilities.

Lesson 2

Time Allotted: One period (50m)

Lesson Topic: Introduction to mitosis

Standards:

- Expectation 1.2
 - The student will pose scientific questions and suggest investigative approaches to provide answers to questions.
 - Indicator 1.2.1
 - The student will identify meaningful, answerable scientific questions.
 - Indicator 1.2.2
 - The student will pose meaningful, answerable scientific questions.(NTB)
 - Indicator 1.2.3
 - The student will formulate a working hypothesis.
- Expectation 1.4
 - The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication.
 - Indicator 1.4.2
 - The student will analyze data to make predictions, decisions, or draw conclusions.
 - Indicator 1.4.8
 - The student will use models and computer simulations to extend his/her understanding of scientific concepts.(NTB)
 - Indicator 1.4.9
 - The student will use analyzed data to confirm, modify, or reject a hypothesis.
- Expectation 1.5: The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.
 - Indicator 1.5.2
 - The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.
 - Indicator 1.5.5
 - The student will create and/or interpret graphics. (Scale drawings, photographs, digital images, etc.)
 - Indicator 1.5.6
 - The student will read a technical selection and interpret it appropriately.
 - Indicator 1.5.8

- The student will describe similarities and differences when explaining concepts and/or principles.
- Indicator 1.5.9
 - The student will communicate conclusions derived through a synthesis of ideas.

Cognitive/Affective Objectives:

- Students will gain experience interpreting scientific images
- Students will be able to visually identify and graphically represent cells at each stage.
- Students will work effectively with peers
- Students will develop their cognitive reasoning
- Students will prepare graphic representations of material

Materials:

- Teacher Needed:
 - Projector
 - PC
 - OneNote Mitosis Lesson Plan 2 Daily Objectives
 - Group Assignment Overview
 - Expert Group Assignment Slide
 - Biology Textbooks
 - Classroom PC
- Student Needed:
 - Pencil
 - Journal
 - Notepaper

Warm-up: (6m)

- Pre-bell
 - Address student questions, identify students that missed previous lesson(s) and speak with them.
 - Prepare class materials/projector with daily question
- Post bell (6m)
 - Present students with question of the day for their journal
 - In yesterday's assignment what was the overall reasoning you used to order the images and would you change anything today?
 - Take attendance
 - Collect previous homework

Motivator/Bridge: - Tied into Developmental Activity for lesson (4m)

- Review Prior learning:
 - Reflection on warmup question (4m)

- Review homework worksheet with whole class response to answers.
- Prior-Knowledge
 - Ask if anyone knows what the images from prior lesson were.
 - Explain images from yesterday were stages of mitosis (cell-splitting).
- Goal-Objective
 - Collaborate in expert groups to learn about your assigned stage of mitosis
 - Become an “Expert” in your assigned stage of mitosis
 - Work together in expert groups to create a fact sheet for your stage

Developmental Activity: (35m)

- Assign expert group roles (use group assignment sheet) and group locations within the classroom (2m)
 - Use projector to display assignment
- Allow students to move to groups (3m)
- Describe student tasks (5m)
 - Research (Using textbooks, phones, PC)
 - Record (Create summary and drawing of assigned stage)
 - Each group member should have personal copy
 - Summary should include information on
 - What is occurring
 - Length of time needed
 - Use of appropriate terminology as outlined on group worksheet.
 - Drawing should include labels provided on group worksheet
- Start Timer (25m)

Assessment:

Walk around during group work and observe student interaction. Ensure students are staying on task within the groups. Identify students that are not participating or having behavioral issues and engage/motivate them. Cycle through each group and discuss what they are learning, inquire about difficulties they are encountering and answer questions they may have.

Summary/Closure: (5m)

- Focus student attention from group back to teacher
- Brief overview of next period’s assignment (Poster) with home group
- Brief overview of homework
- Answer any questions

Review/Reinforcement:

- Homework Assignment:
 - Self-exploration of the assigned stage of mitosis
 - Review of notes/image created in class

- Correct or add to the class-created image in preparation for “teaching” it to your home group in next lesson.

Adaptation:

- Written instructions provided for students that may need it
- Student with ADHD put in a group with strong leadership student
- Disabled student placed in a group that will be located at their desk to reduce need to move around classroom.
- Student with reading disorder placed in group with technology adept students.
- Ability to utilize technology (internet) provides a variety of medium for information to be accessed.
- Notes can be created via technology or standard methods
- Additional work can be completed for assignment at home allowing for extended time.

Reflection:

For all students, regardless of capability, high schools interactions play a large role in the development of self-identity (Rich & Schachter, 2012). In the classroom these interactions are generally seen during collaborative work. Levine argues that teachers should be “splitters not lumpers”, in other words they should seek to promote heterogeneous grouping (Levine, 2002, p. 47). This promotes interdependence, accountability, and friendly competition within the classroom and is one of the most important aspects of cooperative learning (Snowman, 2011, pp. 472-473). While teachers utilize grouping strategies within the classroom for instructional purposes it is important to remember that students already form groups on their own outside of the classroom. Without any teacher direction the groups that may form will not necessarily be equitable. In the classroom presented, the inclusive and diverse representation required me to generate group assignments in order to create the most heterogeneous and equitable group possible. By having students collaborate, the classroom environment becomes one of greater equity where students don't differentiate each other based on cultural, physical, or economic traits (Nieto, 2010, p. 121). One of my key focuses in the group creation was to assign the student with a physical disability to a group that would form around him rather than require him to move around the classroom. I also choose to group the ADHD student with a strong leader. My reasoning was that an identified leader would work to keep the group on task and keeping the ADHD student engaged. One of the biggest benefits of this exercise is the utilization of assistive and instructive technology by students to accomplish their research (Roblyer & Doering, 2013, p. 401) This allows students across a wide spectrum of learning and physical ability to comprehend and internalize the material. ADHD students can use technology to research their assigned stage of mitosis. This provides a combination of auditory and visual information which can help keep a student stimulated. This use of technology also provides “at your fingertips” methods of research without requiring physical movement for students with a physical disability. Technology also allows alternative methods such as video, interactive games, or audio that may engage a higher proficiency multiple intelligence improving the internalization of students with reading comprehension difficulties.

Lesson 3

Time Allotted: One period (50m)

Lesson Topic: Introduction to mitosis

Standards:

- Expectation 1.2
 - The student will pose scientific questions and suggest investigative approaches to provide answers to questions.
 - Indicator 1.2.1
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 - The student will use analyzed data to confirm, modify, or reject a hypothesis.
- Expectation 1.5: The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.
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- The student will describe similarities and differences when explaining concepts and/or principles.
- Indicator 1.5.9
 - The student will communicate conclusions derived through a synthesis of ideas.

Cognitive/Affective Objectives:

- Students will gain experience interpreting scientific images
- Students will be able to visually identify and graphically represent cells at each stage.
- Students will work effectively with peers
- Students will develop their cognitive reasoning
- Students will prepare graphic representations of material

Materials:

- Teacher Needed:
 - Projector
 - PC
 - OneNote Mitosis Lesson Plan 2 Daily Objectives
 - Group Assignment Overview
 - Home Group Assignment Slide
 - Biology Textbooks
 - Classroom PC
 - Poster Paper
 - Colored markers/pencils
 - PC Tablets (with drawing)
- Student Needed:
 - Pencil
 - Journal
 - Expert group notes

Warm-up: (0m)

- Pre-bell
 - Have home group assignments displayed on projector. Instruct students to sit according to seating assignment.
 - Address student questions, identify students that missed previous lesson(s) and speak with them.
 - Prepare class materials/projector with daily question
- Post bell (0m)
 - No warmup today, need full class period for group assignment and poster creation.
 - Take attendance

Motivator/Bridge: (1m)

- Have students take out expert group summary
 - Make sure everyone has their expert group summary/image
- Goal-Objective
 - Collaborate in home groups to teach your other group members about your stage of mitosis.
 - Collaborate to create a visual representation of the stages of mitosis.

Developmental Activity: (47m)

- Describe student tasks (2m)
 - Each student will have 3 minutes to teach their stage of mitosis to the rest of the group (15m total)
 - Each group will have 30 minutes to draw and label their poster of the mitosis cycle.
 - Posters graded based on a provided rubric
- Start Timer (47m)

Assessment:

Walk around during group work and observe student interaction. Ensure students are staying on task within the groups. Identify students that are not participating or having behavioral issues and engage/motivate them. Cycle through each group and discuss what they are learning, inquire about difficulties they are encountering and answer questions they may have.

Summary/Closure: (2m)

- Focus student attention from group back to teacher
- Find out if students need more time to complete posters (raise hands)
- Answer any questions

Review/Reinforcement:

- Homework Assignment:
 - Mitosis Coloring Assignment
 - Students will label and color a full cycle of mitosis stages provided in outline.

Adaptation:

- Written instructions provided for students that may need it
- Student with ADHD put in a group with strong leadership student
- Disabled student placed in a group that will be located at their desk to reduce need to move around classroom.
- Student with reading disorder placed in group with technology adept students.
- Students may use technology to create images/posters. (Provide tablets).
- Can provide additional time for poster creation during next class session (max 15 minutes).

Reflection:

The biggest difficulty with this session is time management. Students need to work efficiently in order to both share the information from the expert session as well as create the finished poster. Time allotment for poster creation may be required in the next session. Revision of this lesson to include an additional day may be necessary in the future. Future adaptation of this lesson to make full use of computer poster design is possible. This would also allow for at-home collaboration on the poster. I don't feel that group work, at the public high school level, is a fair requirement outside of the classroom.

The overall concept of this lesson design was to promote student-centered learning through the usage of a scaffolded approach(Snowman, 2011, p. 457). By starting on Lesson 1 with the self-guided assignment and then concluding it with the use of home-expert groups, students are kept engaged through peer interaction and external motivation (have to teach their peers).

One of the ways of differentiating this assignment is by forming smaller groups where some students were responsible for multiple stages instead of one.

Poster Rubric:

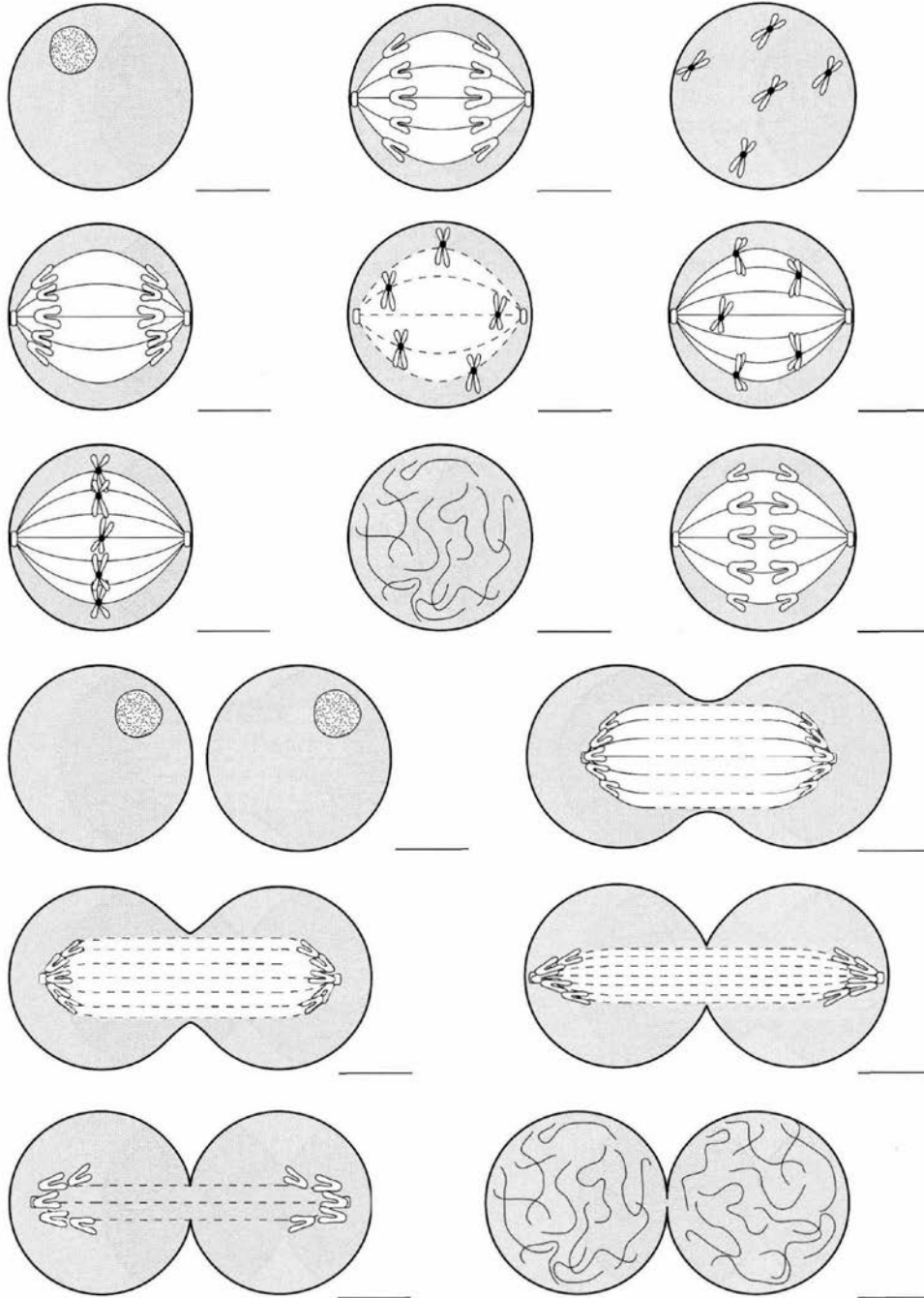
	5 (A)	4 (B)	3 (C)	2 (D)	Score
Graphics	<ul style="list-style-type: none"> • Detailed graphics • Provides clear understanding of mitosis stages. 	<ul style="list-style-type: none"> • Use of Color • Well formatted graphics of stages. 	<ul style="list-style-type: none"> • All stages represented by graphics 	<ul style="list-style-type: none"> • Poster is missing stage graphics. 	
Labels	<ul style="list-style-type: none"> • Labels are easy to read • Labels clearly identify what they represent. 	<ul style="list-style-type: none"> • Labels are color coordinated to cell sections 	<ul style="list-style-type: none"> • All labels included 	<ul style="list-style-type: none"> • Some labels missing 	
Stages	<ul style="list-style-type: none"> • All stages in correct order 	<ul style="list-style-type: none"> • All stages represented no more than 2 in wrong order. 	<ul style="list-style-type: none"> • All stages represented 3 or more in wrong order. 	<ul style="list-style-type: none"> • Some stages missing 	
Content	<ul style="list-style-type: none"> • Poster includes extra non-required information • Poster is very well organized • Poster provides a very clear conveyance of the stages of mitosis. 	<ul style="list-style-type: none"> • Poster includes group names/title. • Poster is well organized • Poster does a good job of conveying the stages of mitosis. 	<ul style="list-style-type: none"> • Poster is organized • Poster is missing group names, or title. • Poster does not clearly convey the stages of mitosis 	<ul style="list-style-type: none"> • Poster appears disjointed and sloppy • Missing title, group names • Poster does not convey the stages of mitosis. 	

Worksheet 1

Adapted from: (Shields, 2006, p. 102)

Name _____ Date _____

Worksheet 1



Copyright © 2006 by John Wiley & Sons, Inc.

Figures 3.5-3.19. Fifteen Phases in a Sequence
 Reprinted with the permission of the National Association of Biology Teachers. Daneley, H. (1996).
 Exploring mitosis through the learning cycle. *The American Biology Teacher*, 52(5), 196.

Homework 1 (Parts of the Cell)

Adapted from: (DiStasio, 1999, p. 28)

PARTS OF THE CELL—MATCHING

Name _____

Match the descriptions in Column I with the name in Column II.

Column I

- _____ 1. holds nucleus together
- _____ 2. surface for chemical activity
- _____ 3. units of heredity
- _____ 4. digestion center
- _____ 5. where proteins are made
- _____ 6. structures involved in mitosis in animal cells only
- _____ 7. microscopic cylinders that support and give the cell shape
- _____ 8. shapes and supports a plant cell
- _____ 9. stores and releases chemicals
- _____ 10. food for plant cells is made here
- _____ 11. spherical body within nucleus
- _____ 12. controls entry into and out of cell
- _____ 13. traps light and is used to produce food for plants
- _____ 14. chromosomes are found here
- _____ 15. jellylike substance within cell
- _____ 16. contains code which guides all cell activities
- _____ 17. minute hole in nuclear membrane
- _____ 18. "powerhouse" of cell
- _____ 19. contains water and dissolved minerals
- _____ 20. stores food or contains pigment

Column II

- a. Golgi bodies
- b. nucleus
- c. chromosomes
- d. vacuole
- e. ribosomes
- f. endoplasmic reticulum
- g. nuclear membrane
- h. centrioles
- i. cytoplasm
- j. chlorophyll
- k. chloroplasts
- l. cell (plasma) membrane
- m. cell wall
- n. mitochondria
- o. lysosome
- p. genes
- q. nuclear pore
- r. nucleolus
- s. plastid
- t. microtubule

Expert Group Assignment Overview:

Expert Group Assignment

Your job is to research your assigned stage of mitosis using any means that you wish. This includes the classroom PC, textbooks, prior knowledge, and your cell phones.

You will create a short summary of your stage that includes the following parts:

- All members need to create their own copy of summary and diagram as you will be sharing this with students from other stages tomorrow where you will share your knowledge with them and collaborate to design a poster that shows the full stage cycle of mitosis.
- Overview composed of at least 4-5 sentences.
- Estimated time for stage to complete
- Diagram of an animal cell undergoing your assigned phase of mitosis.
 1. Use color to highlight different parts of your stage
 2. Label the following parts as appropriate to your stage:

❖ Interphase

1. Cell membrane
2. Nuclear membrane
3. Nucleolus
4. Chromatin strands in:
 - Nucleoplasm
 - Centrioles

❖ Prophase

1. Cell membrane
2. Chromatids
3. Centromere
4. Cytoplasm
5. Centrioles
6. Spindle Fibers

❖ Metaphase

1. Cell membrane
2. Chromatids
3. Centromere

4. Centrioles

5. Spindle fibers

❖ Anaphase

1. Cell membrane
2. Cytoplasm
3. Centromeres
4. Centrioles
5. Spindle fibers
6. chromatids

❖ Telophase

1. Cell membrane
2. Cytoplasm
3. Chromatin strands
4. Nuclear Membrane
5. Nucleolus
6. Cleavage furrow
7. Centrioles

Home Group Assignment Overview:

Home Group Assignment

Your job is to share your knowledge on your assigned stage of mitosis with your group and then collaboratively create a poster that clearly displays the entire mitosis cycle. You may use the tablets to design your poster or you may use the poster paper, colored pencils, and markers provided.

Your group will design a poster of the mitosis cycle that includes the following parts:

- Graphic representation of each stage of mitosis
- Short description of each stage composed of at most 4-5 sentences
- Estimated time for stage to complete
- Title, labels, group names
 1. Use color to highlight different parts of the stage/cell
 2. Label the following parts of each stage/cell:

❖ Interphase

1. Cell membrane
2. Nuclear membrane
3. Nucleolus
4. Chromatin strands in:
 - Nucleoplasm
 - Centrioles

❖ Prophase

1. Cell membrane
2. Chromatids
3. Centromere
4. Cytoplasm
5. Centrioles
6. Spindle Fibers

❖ Metaphase

1. Cell membrane
2. Chromatids
3. Centromere

4. Centrioles

5. Spindle fibers

❖ Anaphase

1. Cell membrane
2. Cytoplasm
3. Centromeres
4. Centrioles
5. Spindle fibers
6. chromatids

❖ Telophase

1. Cell membrane
2. Cytoplasm
3. Chromatin strands
4. Nuclear Membrane
5. Nucleolus
6. Cleavage furrow
7. Centrioles

Posters will be graded based on the supplied rubric!

Remember to use the rubric as a guideline when designing your poster!

References:

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