Motivation:

- The teacher will briefly review the facts about DNA composition. It is the “blueprint” or “recipe” for all of our physical construction in that it codes for protein synthesis. (3 minutes)

- Inquiry novelty poses open-ended questions (5-7 min): (Optional: The teacher pours some pancake batter onto a preheated skillet and flips two or three.) Holding up the clear bowl of prepared batter and the pancake box, a discussion ensues about not having enough batter to feed all of the class. How do we double a recipe?

  Teacher suggests: “Since I haven’t enough batter to make all of you pancakes, I think I will add more water to double the amount of batter.”

  Responses will testify to the fact that the batter will develop a different consistency if only water is duplicated. The pancakes will not be the same as the original ones being made.

  Teacher suggests: “All right, then. I will add another egg and the water.”

  Students will attest to the fact that just adding two ingredients will still alter the desired consistency of the batter. You should double everything to keep the pancakes the same.

- The following discussion question is presented to the entire class:

  If a cell is going to divide, creating two “daughter” cells that are identical, what must
Students should recognize that the daughter cells must contain the same components as the parent cell in order for them to function as the parent cell functions. The instructions (the DNA) must be copied with accuracy. Other organelles are manufactured during the G2 stage. Then the copied portion of the DNA must be able to separate from the original strands of DNA.

- Students are issued a multiple-choice and short answer pre-test to assess what they already know about cell division. (10 min)

- The teacher uses the animation “How the Cell Cycle Works” to give students an overview of mitosis. Animation: http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_the_cell_cycle_works.html

**Needed Materials & Set-Up:**

**Materials:**

- Oreo cookies with white filling (6 cookies per group of 2-3 students)
- Rod-shaped candy sprinkles, assorted colors (2 tablespoons of assorted colors per group)
- Snack size resealable sandwich bags (2 per group)
- Toothpicks (6 per group)
- Paper towels (3 per group)
- “Oreo Mitosis” lesson worksheet (one copy per student)

Optional-

- One box of pancake mix
- Large spoon and bowl of prepared pancake mix (so consistency can be seen)
- Optional tabletop skillet / pancake turner

Prior to the lesson, separate the Oreo cookies into one of the snack bags, and place the sprinkles and toothpicks for each group in the other snack bag. Each group will receive a bag with cookies and a bag with toothpicks and sprinkles.

**Set-Up:**

When students initially enter the room, they will sit in their assigned seats facing the whiteboard. Following the motivation, the students will be grouped by the teacher into groups of 2-3 students. The students will be directed to arrange their desks in a T configuration, with two desks facing each other and the other desk facing the two desks that are in direct contact. The students will remain in this configuration until the end of the lesson.
Next Generation Sunshine State Standards:
SC.912.L.16.14 Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.

SC.912.L.16.3 Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.

The Three Dimensions of the K-12 Science Education Standards
1. Scientific and Engineering Practices
   2. Developing and using models
2. Crosscutting Concepts
   2. Cause and effect: mechanism and explanation
   6. Structure and function
3. Disciplinary Core Ideas
   Life Sciences – LS 1: From molecules to organisms: Structures and processes

Common Core Literacy Standards
1. Reading Standards – Integration of Knowledge and Ideas, Key Ideas and Details
2. Speaking and Listening Standards – Comprehension and Collaboration

Student Learning Outcomes
1. Given edible components to represent parts of the cell, the students will accurately model the key events in the stages of the cell cycle, to include interphase, prophase, metaphase, anaphase, telophase and cytokinesis with 100% accuracy.
2. After creating a model of the stages of the cell cycle, the students will describe the key events of each stage of mitosis as reflected in their cookie models with 100% accuracy.
3. Given a post-test following the mitosis modeling activity, students will apply the content information gained by answering questions relating to the process of mitosis with 80% accuracy or better.

Assessment Results
The post-test results will be returned to the students on the day following the activity. The teacher will display the post-test answer key document on the projector. The students will have the opportunity to discuss any questions they may have missed on the post-test with the teacher and the class.

A formative assessment of student achievement includes the construction of each phase of the cell cycle using Oreo cookies, which is reviewed by the teacher upon completion by each group.
Presentation and Participation:

- After showing the video animation, the teacher explains that the objective of today’s lesson is for the students to create a model of the steps of the cell cycle using Oreo cookies and candy sprinkles.

Lesson Set-Up & Safety (5-7 minutes)
- The teacher assigns students to groups of 2-3 people. The students are requested to arrange their desks in a T-arrangement for each group, and the desk arrangement is drawn on the board for the students to visualize.
- After the groups have assembled, and the desks are properly arranged, the teacher provides each student in the classroom with a lesson worksheet to complete during the modeling activity.
- The teacher reviews safety concerns for the lesson prior to distributing supplies.
- The teacher provides each group with 6 Oreo cookies, 2 tablespoons of rod-shaped multi-colored candy sprinkles, 3 paper towels and 6 toothpicks.

Lesson Instructions (5 minutes)
- The teacher explains that the group will use one of each of the Oreo cookies to model the following stages of the cell cycle: Interphase, prophase, metaphase, anaphase, telophase (mitosis) and cytokinesis.
- The teacher explains that if two people are present in the group, each person should model three of the six stages assigned. If three people are present in the group, each person should model two of the six stages assigned.
- The teacher models how to separate the Oreo cookie so that the top cookie is removed and the cream filling and other cookie are used for the model (BEHAVIOR).
- The teacher explains that the student models should show the key events for each phase of the cell cycle.
- The teacher explains that students should reference their textbook for assistance on recreating each stage of the cell cycle.
- The teacher reviews classroom rules regarding movement, behavior and volume for this type of activity.

Student Activity (15 minutes)
- The students are now permitted to create the models of the stages of the cell cycle within their assigned groups (COGNITIVE).
- As the students create the models, they complete the Oreo Mitosis worksheet.
- When the models for all stages are complete, the students must get the approval of the teacher to determine if the models are accurately depicted (OTHER).

Post-Test (5-7 minutes)
- After the teacher’s approval, the students may complete the post-test for the lesson.

Questions:
1. (Evaluation) Conclude why it is necessary for chromatin to **condense** before cell division takes place?
   Explain and justify your answer.
   Chromatin in its tangled, elongated form would easily break if not condensed during mitosis, as the spindle pulls the chromosomes to opposite ends of the cell.

2. (Evaluation) Based on what you know, how would you explain why some cells have a shorter cell cycle than others.
   Some cells undergo more wear and tear in the body, such as those in the digestive tract. These cells need to constantly be replaced to maintain function in the body.

3. (Evaluation) Explain and justify why **interphase** consumes the majority of time in a cell cycle.
   During interphase the cell needs time to grow and provide the necessary components, including organelles to create two new daughter cells. Chromosomes are duplicated during this phase as well.

4. (Synthesis) Where are the chromosomes located in the cell during each of the four different phases of mitosis? Create a pictograph from the written description in your book, using the given materials on your desk. (Oreos and sprinkles)
   Students should indicate the chromosomes first being within the nucleus, then lined up in the middle of the cell. The third drawing should show the chromosomes being pulled toward opposite ends of the cell, then surrounded by two separate nuclear envelopes.

5. (Analysis) Distinguish between the first phase, **prophase**, with the final phase of mitosis, **telophase**?
   During prophase, the nuclear envelope breaks apart and disintegrates from around the newly coiled and replicated chromosomes and the centrioles move toward opposite ends of the cell. At the end of mitotic phases, the new nuclear membranes develop around the nuclei, the chromosomes uncoil and become tangled, elongated masses of chromatin, and the centrioles move close to the new nuclei.

6. (Analysis) What is one distinguishing difference in plant cell mitosis when compared to animal cell mitosis?
   Plants do not go through the process of cleavage in the cell membrane as animal cells do. They develop a cell plate structure down the middle of the two new cells. A new cell membrane then forms around each cell. Plants have asters, rather than centrioles, that hold the mitotic spindle in place.
**Reflection:**

An initial pre-test at the onset of the day 1 lesson plan will provide the teacher an assessment of the students’ initial set of knowledge prior to the instruction. An identical post test administered at the close of the class session will measure cognitive growth. The test is a compilation of multiple-choice and short answer questions. Students will be able to view their net gain score from pre-test to post-test as the teacher distributes them. A post-test score lower that 80% will require the student to complete a homework assignment- “Phases of Mitosis” worksheet. (See attached.)

Formative assessment will also occur throughout the lesson as the teacher circulates and asks questions during the teaching session.

Verbal feedback will be provided to individuals throughout the lesson based on their answers to the teacher’s oral questions as well as during the group Oreo mitosis modeling activity.

**Safety:**

On the day prior to the lesson, the students will be advised that Oreos and sprinkles will be used for an activity on the following day. The food items may be consumed at the conclusion of the exercise, however if a student has a food allergy, they should refrain from consuming the materials.

If the pancake demonstration is used, be sure to unplug the skillet before progressing on.

Toothpicks will be used to manipulate the crème filling in the Oreos. During the lesson set-up and safety segment, students will be instructed that toothpicks can inflict harm and should be used only for the intended purpose.

The teacher will advise the students to clean up any spills quickly to prevent the floor surfaces from becoming slippery and unsafe.

**Transformative:**

ESE
1. Group lower-performing students with a moderate to high performing student to assist them with the Oreo mitosis activity.
2. Instead of modeling two phases of the cell cycle, ESE students may model only one stage of the cell cycle.
3. Students that will require one-on-one assistance from the teacher should be placed near the edge of the group arrangements to prevent embarrassment from peers when receiving assistance.

**ESOL/LEP**
1. Following the video clip, discuss the meanings of the root words/prefixes inter-, pro-, meta-, ana-, telo-, and cyto-. Discuss other words that have the same root word/prefix.
2. During the animation segment of the cell cycle, choose to display the script of the audio so students can read the words as the narrator says them during the animation.

**Behavioral**
1. Students with behavioral concerns may be grouped with a positive peer influence to minimize distractions from negative influences.

**Utilize:**

**Challenges:**
- Students may find it difficult to lay out the “cookie mitosis cells” on slanted desks. If tables are available, some students enjoy standing while working on the project.
- Students can be instructed to take turns reading the phase description from the text while another manipulates the pattern on their two or three cookies. Roles can then be switched, giving each group member attention to each phase, instead of just their own particular phase.
- Candy “red hots” may be used to represent the centrioles; a variety of small candies may be implemented as giving more distinction to the cell components.
- Small ice cream cup “paddle spoons” work well if using toothpicks is not desired.
- After reviewing missed questions on the pre and post-tests, determine what if any concepts need to be readdressed. If the same test question was answered incorrectly on both tests by 40% or more of the students, these items will need to be reviewed in the next day’s lesson.

**Strengths:**
- Lesson can also be extended to model plant cell mitosis. One group may be assigned to complete a plant cell mitosis, rather than an animal cell, including the cell plates and asters.
- The extra cookie award for the best acronym is a sure attention holder after the activity with the cookies ends.
- A quick camera shot of the 6 cookies with group members (holding them on a rimmed
cookie sheet in proper order) is a sure incentive for completing on time. Photos can be posted in the room.