

Unit Plan

Introduction

The following timeline estimate is based on teacher experiences during Nano Legends™ field testing, during which approximately 90% of the students were able to finish the game within three to five hours. The variance in the range was mostly due to differences in gaming experience. More experienced players tended to finish the game quicker than less experienced players, which is to be expected. A few players who had virtually no gaming experience did not finish the game in this amount of time.

Teachers included a variety of other learning opportunities to reinforce the content presented in Nano Legends™. This unit plan outlines a suggested three-week sequence for completing a unit on cell biology using Nano Legends™ as the core resource.

Classes are assumed to be 45 to 50 minutes long. Note that the activity times are estimates; actual time will vary based on each classroom's unique learning environment.

Before Using Nano Legends™ in Your Class

1. Read the seven chapter overviews to provide a context for the Nano Legends™ cell biology unit.
2. Review the Nano Legends™ correlation to the National Science Education Content Standards and your state or provincial curriculum.
3. Book and confirm the necessary computer time in your school computer lab. Decide whether you will install Nano Legends™ before the first lesson or you will ask students to install Nano Legends™ during the first lesson. Check to ensure that Nano Legends™ will load properly on the school computers. (Some school network security systems may cause log-in problems. Refer to Section II Technical Support in this guide or go to www.nanolegends.com if any issues arise.)

Nano Legends™ Unit Plan

Lesson	Overview	Time
Introduction	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Have students brainstorm words they know about cells. Create a word wall of these words. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Introduce Nano Legends™. • Have students log in to Nano Legends™ and troubleshoot as needed. • Students begin Nano Legends™. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Review key characters and key procedures for using Nano Legends™. 	45 minutes (1 class)
Chapter 1: The Beginning	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Using terms from the word wall, ask students to describe a normal functioning cell. Define the characteristics of cells as outlined in Chapter 1, Basic Science Concepts. • Tell students they will be expected to describe the major events that happened in the story. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Students complete Chapter 1. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • As students finish Chapter 1, have them complete the Chapter 1 review. • Using the Chapter 1 image bank, select five images and have students describe each image to their lab partner or a classmate. • If time permits, use the Chapter 1 discussion questions to review the concepts covered in the lesson. • Review with the class any tips or tricks students observed in the chapter. For example, they may have discovered how to complete a double jump or what it means when Aerin turns red. 	45 minutes (1 class)

Nano Legends™ Unit Plan (continued)

Lesson	Overview	Time
<p>Chapter 2: Entering the Cell</p>	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Using the images from the Chapter 2 Image Bank, have students predict what they think might happen to Aerin and LOR. • Introduce the terms cell membrane, passive transport, and active transport. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Students begin Chapter 2. • As students work through Chapter 2, it may be necessary at the beginning of the second class to explain the function of transport proteins, the selective barrier, glucose, and proteins. The image bank contains excellent images to reinforce each of these concepts. • Students complete Chapter 2. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Review the images used at the start of the lesson and have students write what happened in each image. Students should use words from Chapter 2 listed on the word wall in their descriptions. • If time permits, hand out Chapter 2 review sheet or use the review questions to discuss the major concepts covered in this lesson. • Review with the class any tips or tricks they observed during the chapter. 	<p>90 minutes (2 classes)</p>
<p>Chapter 3: The Mitochondrion</p>	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Have students complete Chapter 3 of Nano Legends™. • Tell students they will be responsible for describing the following terms by the end of Chapter 3: organelles, mitochondria, cellular respiration, and carcinogens. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Use the discussion questions, basic science notes, and images to discuss cellular respiration and the function of the mitochondria. • Only a brief mention of carcinogens is required at this point; Chapters 6 and 7 will go into more detail. • Add new terms to the word wall. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Have students complete Chapter 3 review or create a concept map illustrating their understanding of the key terms in this chapter (see list of terms in Chapter 3 review). • Review with the class any tips or tricks they observed during the chapter. 	<p>45 minutes (1 class)</p>

Nano Legends™ Unit Plan (continued)

Lesson	Overview	Time
Chapter 4: mRNA	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Review basic science terms from Chapter 3, listed in the review. • This chapter is about Aerin and LOR beginning to develop a plan to attack the cancer. Tell students that during this lesson they will create a storyboard of the plan, using images copied from the Teacher’s Guide. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Students complete Chapter 4. Remember to have students complete the questions at the end of the chapter. • Students who finish early can add words to the word wall. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Once students have completed Chapter 4, have them cut out the photocopied images and create their own storyboard of Aerin’s and LOR’s plan. If time permits, have students present their work to the class. • Have students complete the Review. 	90 minutes (2 classes)
Chapter 5: Protein Synthesis	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Students complete Chapter 5. • Have students create a list of new terms they encounter in the chapter and provide their own definition for each term. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Using the images provided in the Teacher’s Guide, review the key steps in protein synthesis. Note that the depth of treatment will vary according to class abilities. Most students should be able to understand the function of the ribosome, endoplasmic reticulum, and Golgi body and the process for creating a protein. • Review the word lists created by students to ensure terms are correctly defined. Add new words to the word wall. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Assign the Chapter 5 review to consolidate understanding. • Have students create a flow chart illustrating the process of protein synthesis, including the terms mRNA, ribosomes, endoplasmic reticulum, and Golgi body or Golgi apparatus. 	90 minutes (2 classes)

Nano Legends™ Unit Plan (continued)

Lesson	Overview	Time
Chapter 6: Carcinogen Wars	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • Discuss with students the aspects of cancer and carcinogens outlined in the Chapter 6 Basic Science Concepts. Use the images provided to show different examples of carcinogens that students will encounter in Chapter 6. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Have students complete Chapter 6. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Have student write a short paragraph describing in their own words how carcinogens cause cancer. Use the carcinogen images provided as a writing prompt to assist students. • Use the Chapter 6 discussion questions and review to consolidate understanding. • Add new terms to the word wall. 	45 minutes (1 class)
Chapter 7: The Nucleus	<p>Begin the Lesson</p> <ul style="list-style-type: none"> • By the end of this chapter, students will have helped Aerin and LOR successfully defeat the cancer. • Assign students a final assessment task of creating a cancer prevention poster, using the information they have collected through the chapters. Encourage students to use as many words from the word wall as they can. • Share the grading criteria for the poster with students. <p>Teach the Lesson</p> <ul style="list-style-type: none"> • Students complete Chapter 7. <p>Assess the Lesson</p> <ul style="list-style-type: none"> • Add new words to the word wall. • Students work on cancer prevention poster. • Have students complete the Review. 	90 minutes (2 classes)
Wrap-up (included in the lesson plan for Chapter 7)	<p>Final Assessment</p> <ul style="list-style-type: none"> • Performance Task: Students share cancer prevention posters with the class. • Written Task: Students take the final exam. • Self-assessment: Students complete a short reflective writing activity on the unit (two stars and a wish). 	45 minutes (1 class)