

## Chapter Mini-Challenge

In each section, students learned new concepts. Now they can recall and review what they have learned and read the *Chapter Mini-Challenge* to address the different phases of the *Engineering Design Cycle*. This is an opportunity for them to reconstruct their learning to meet their *Goal*. Facilitate this process by asking students to reflect on the physics principles of each section. Model a concept map that makes connections between concepts students have learned and the criteria required to complete their *Chapter Challenge*. As students, carry out the process of linking information, point out to them that the *Process* phase is when they decide what information they have that best meets the criteria of their *Goal*. Emphasize that this is the stage of resource analysis, in which students determine what they need to learn to complete their *Chapter Challenge*.

In preparing for their *Mini-Challenge*, students get a chance to work together and share ideas with their class. The purpose behind the *Feedback* phase is to allow time for reflection and explanation. In writing down a first draft of their two-minute presentation, students realize the advantages of sharing information. During this phase of the design cycle, each student should be expected to write two positive comments besides suggestions for improvement.

Chapter Mini-Challenge

Why is there a Mini-Challenge?

You are using a simplified *Engineering Design Cycle* to help you address the *Chapter Challenge*. At the beginning of the chapter, you established your *Goal*. At that time, you also identified the criteria and constraints that you have. You then completed several sections of the chapter. The physics content that you learned about in each section provides the *Inputs* that you can use to address the challenge. As you work through each section, you are also involved in the *Process* phase. You have the opportunity of evaluating the different ideas that you and your team have for how to use and incorporate the physics content into the final product.

Now is the time for the *Outputs* and *Feedback* phases of the *Engineering Design Cycle*. It is time to present the intermediary phases or intermediary products that you have designed. When engineers design products, they usually do not create the best or most successful product on the first try. They often go through many iterations (repetitions) before they have a final product. In *Active Physics*, you will only have one opportunity to present your intermediary product. You will present it in the *Chapter Mini-Challenge*. The presentation is the *Outputs*.

An extremely important phase is the *Feedback*. Other teams will have an opportunity to provide you with formal or informal *Feedback*. You will find out if your product meets the criteria, if you have used the physics concepts correctly, and if your product is entertaining, exciting, useful, or creative. You will also have an opportunity to provide feedback to yourself. You will have a chance to reflect on what went well and what can be improved.

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graph TD
    GOAL[GOAL] --> INPUTS[INPUTS]
    INPUTS --> PROCESS[PROCESS]
    PROCESS --> OUTPUTS[OUTPUTS]
    OUTPUTS --> FEEDBACK[FEEDBACK]
    FEEDBACK --> GOAL
    
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The *Mini-Challenge* is a first attempt at the culminating task. It is the time for students to informally test their understanding of physics principles. For instance, in designing a presentation that highlights the relationship between following distance, braking distance, and the total stopping distance, students will have the opportunity to explain

how these principles are a part of safe driving. Their confidence will increase when they are successful in demonstrating their knowledge of the physics of driving, such as why the GO Zone is affected by the yellow-light time, or how road friction and radius of the curve determine the safe speed for negotiating a curve.



Your challenge for this chapter is to create a two-to three-minute group presentation that will convince the Active Driving Academy that you have learned enough about the physics of safe driving to be eligible for graduation. Your group needs to apply the physics concepts you have studied in this chapter to develop that presentation. Your presentation must, at the minimum, include:

- the relationship between following distance, braking distance, and the total stopping distance, including the factors that affect each;
- how to decide what to do when the light turns yellow as you approach an intersection; and
- the connection between speed, friction, and radius of the curve when turning.

Your *Mini-Challenge* for this chapter is a one-to two-minute presentation to the class. The *Mini-Challenge* will help you learn about what you should or should not include in your *Chapter Challenge* presentation. You will not be able to address all of the requirements at this time, but you should do your best to fully address the topics that you have already studied. Anything you create for the *Mini-Challenge* can be used to complete your final *Chapter Challenge*.

Look back at the *Goal* you wrote at the beginning of the chapter. Rewrite your *Goal* so that you are clear on what you will prepare for the *Mini-Challenge*. Review the *Goal* as a class to make sure you have all of the criteria and the necessary constraints.



For the *Inputs* phase of the *Engineering Design Cycle*, you have completed four sections and learned some of the physics content that can be used in your presentation. Your group should review the physics content from these sections to help you begin your safe-driving presentation.

**Section 1** You used different methods to measure reaction time and compared the reaction time of different members of your class. You also investigated how distractions affect reaction time.

**Section 2** You used a stride and a meter stick to measure distance. You identified the sources of error in measurement and read about units of measurement used in science classrooms and when driving the roads in the United States.

**Section 3** You defined average and instantaneous speed and used strobe pictures, graphs, and equations to represent motion. You also used the equation for average speed to calculate speed, distance, and time. You read about how speed can affect following distance when driving on the roads.

**Section 4** You learned how changes in speed, direction or acceleration are related to time and distance for a moving vehicle. You also interpreted distance-time and velocity-time graphs for different types of motion.

In addition to the information you learned in the first four sections, your group might also like to look for some statistics about safe stopping distances, safe following distances, and safe braking distances as they relate to vehicle accidents. This information would help make your physics information more impressive to the presentation audience.





## Chapter Mini-Challenge



The *Process* phase is when you decide what information you have that will help you meet the criteria of the *Goal*. This *Mini-Challenge* requires a thorough evaluation of the physics you have learned so far to help you determine how each piece influences the aspects of time and distance as they relate to driving. You can perform a *Resource Analysis* by creating a list of what you learned in the first four sections of the chapter. For each one, decide if:

- it can be used to help you measure or determine a safe following distance;
- it can be used to help find a braking distance, and
- it can be used to find a stopping distance.

By categorizing the information you already have learned, you can focus your energy on addressing the parts of the challenge that you are prepared to answer at this point.

Your *Resource Analysis* has revealed which of the topics in the first four sections will be helpful for answering each part of the challenge presentation. Your group might assign individuals or teams of two to work on specific answers for your presentation and then put all of the individual answers together to present later. Each person or team will now know which chapter section or sections they can use to help him/her address their part of the presentation.

During your *Resource Analysis* you can also make a list of missing information you still need to complete the *Chapter Challenge*. This list will help you complete the final sections of the chapter and frame your answers to the *Physics Essential Questions*.



The *Outputs* of your *Engineering Design Cycle* is a two-minute presentation. Remember, everyone is working with the same requirements and constraints. You only need to do a good job of meeting the *Goal* requirements to do well.

Presenting your information to the class are your design-cycle *Outputs*. You should have a presentation that addresses factors for safe following distances, safe braking distances, and safe stopping distances. Remember to use graphs or charts from the investigations to help illustrate your explanations. Remember to leave enough time for your group to rehearse or at least agree on who will present which information.



Finally, you will receive *Feedback* from your classmates that will tell you what you have done well according to the criteria from the *Goal*. They might also tell you some things you can improve to get a good grade on the final presentation. To give good *Feedback*, it is important to consider each point of the requirements and the constraints to see how well each different design satisfies them. Your statements should say which parts were satisfied and which, if any, were not. This is an objective process and should focus on the products, not on the engineers who produced them.

This *Feedback* will become an *Input* for your final design in the *Chapter Challenge*. You will have enough time to make corrections and improvements, so you will want to pay attention to the valuable information they provide. Remember to correct any parts of your explanations that you received critical feedback on. You may have also learned something from watching presentations that you want to add to your group's presentation. It will be easier and faster to improve your answers now rather than waiting until the chapter is complete to go back and correct any mistakes. Then, store all of your information in a safe place so that it will be ready to use in the *Chapter Challenge*!

