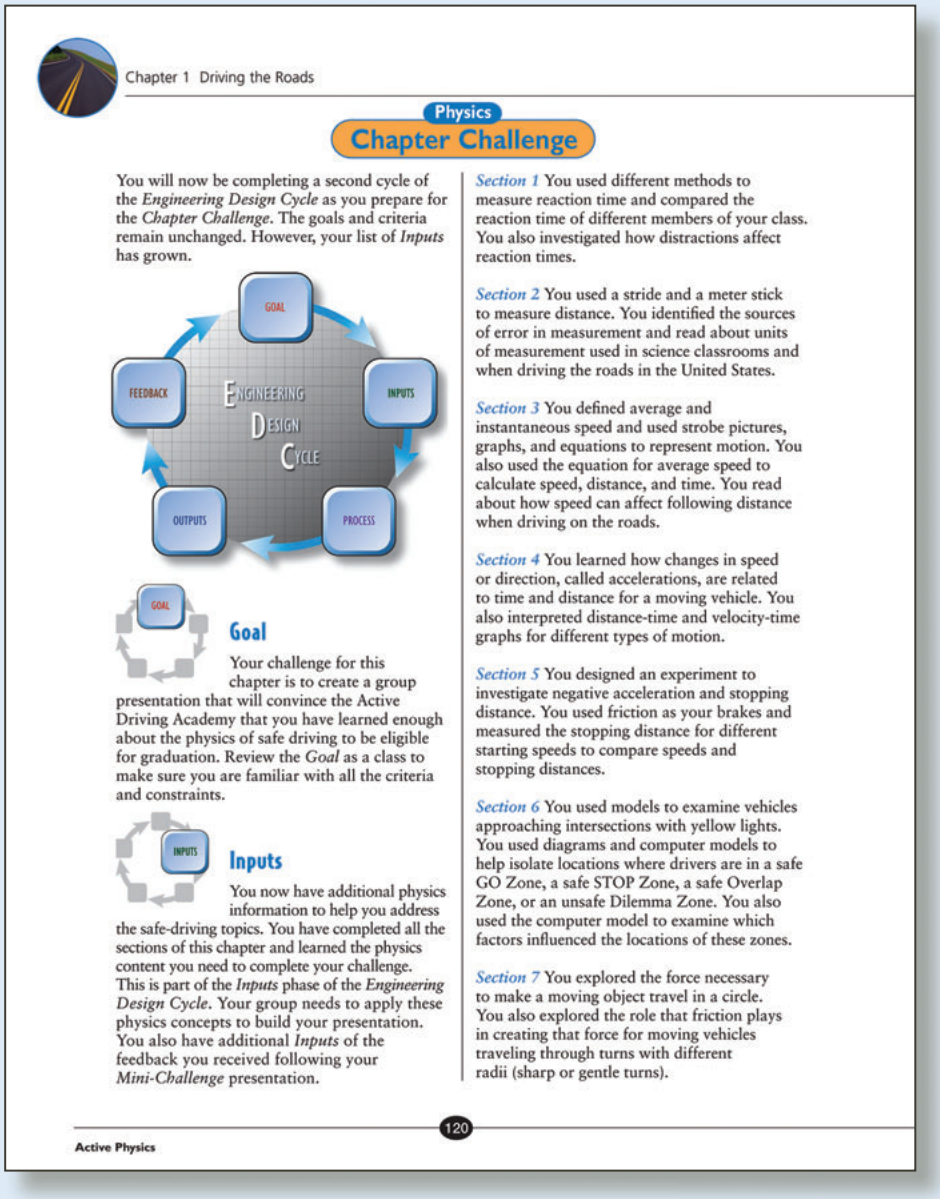
Physics Chapter Challenge

As students prepare for the *Chapter Challenge*, they go through a second iteration of the *Engineering Design Cycle*. They should now be able to articulate their *Goal* and be clear about the criteria defined in their rubric. The challenge for students is to incorporate the concepts they have learned and build them into their final presentation. For this purpose, a brief summary of each section provides them with the opportunity to reflect on what they have learned. They can now see how additional *Inputs* helped to develop the physics content they knew during their *Mini-Challenge*. Consider pointing out how the yellow-light model applies the concepts of GO and STOP Zones to determine whether or not an intersection has a Dilemma Zone and is safe.

During the *Process* phase, students will have a chance at filtering and refining their information. They will be better equipped during this phase if they are encouraged to share their ideas with the group members to compare and contrast their response to driving situations they might face. Emphasize that once students have decided which model of safe driving they will be describing, they should organize ideas and think of creative ways to present the *Chapter Challenge*. Address readability of text and illustrate how different styles of presentation enhance the audience's interest and focus.



Chapter 1 Driving the Roads

Physics

Chapter Challenge

You will now be completing a second cycle of the *Engineering Design Cycle* as you prepare for the *Chapter Challenge*. The goals and criteria remain unchanged. However, your list of *Inputs* has grown.

Goal

Your challenge for this chapter is to create a 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. Review the *Goal* as a class to make sure you are familiar with all the criteria and constraints.

Inputs

You now have additional physics information to help you address the safe-driving topics. You have completed all the sections of this chapter and learned the physics content you need to complete your challenge. This is part of the *Inputs* phase of the *Engineering Design Cycle*. Your group needs to apply these physics concepts to build your presentation. You also have additional *Inputs* of the feedback you received following your *Mini-Challenge* 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 times.

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 or direction, called accelerations, are related to time and distance for a moving vehicle. You also interpreted distance-time and velocity-time graphs for different types of motion.

Section 5 You designed an experiment to investigate negative acceleration and stopping distance. You used friction as your brakes and measured the stopping distance for different starting speeds to compare speeds and stopping distances.

Section 6 You used models to examine vehicles approaching intersections with yellow lights. You used diagrams and computer models to help isolate locations where drivers are in a safe GO Zone, a safe STOP Zone, a safe Overlap Zone, or an unsafe Dilemma Zone. You also used the computer model to examine which factors influenced the locations of these zones.

Section 7 You explored the force necessary to make a moving object travel in a circle. You also explored the role that friction plays in creating that force for moving vehicles traveling through turns with different radii (sharp or gentle turns).

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Reiterate that a model similar to the ones used in *Section 6* utilize a fixed reference from which safety requirements can be clearly explained. Point out that the use of a model in their presentation will enable them to bring in the nuances of concepts that they would like to discuss in their presentation. During the *Process* phase, students should refer to the *Goal* and the rubric to guide their work.

As students get ready to present, remind them that should pay careful attention to their presentation skills for their *Outputs* phase, which requires an engaging, well-developed analysis of *Inputs* that have been honed and designed through a process to create a well-developed product.

The *Feedback* stage is designed to help students assess their

Process

In the *Process* phase you need to decide what information you have that you will use to meet the *Goal*. Decide on the format for your presentation. Will your group compare and contrast different driving scenarios and their safe distances, or will you simply address each of the distances individually? You may also have your own excellent idea for organizing your answers. Creativity is encouraged and will help your presentation be memorable to the judges of the Active Driving Academy. Just make sure that every member of your group is included and knows how she or he can contribute to your presentation.

Consider charts, graphs, and diagrams for your presentation. Your presentation could certainly include charts, graphs, and diagrams to illustrate your ideas. Remember to make any materials that you include neat and readable in the presentation format your group will use. Colors and large text can help make your point clearer.

This chapter made extensive use of models in *Section 6* for considering the complex analysis of the yellow light. A similar model would allow you to compare and contrast safe distances for following, braking, and stopping under different driving scenarios. A model for safe driving in curves could also help you compare the different factors that ensure safety for the passengers there. Your group could use models to find and present answers for each of the three safe driving considerations in the challenge. A model will provide a fixed reference point from which you can consider individual changes like a faster speed, more time to react, a sharper curve, and so on. When you describe the result for each change in the model, you enable the audience to easily compare the result to the results for a previous set of design conditions. Models can be very useful for learning and presenting information.

Address each of the three safe-driving topics. Refer back to the goal and constraints for the presentation regularly to make sure you are answering each part. If your class has a grading rubric for the challenge, use that to guide your work so that you don't forget to include any important information.

Outputs

Presenting your information to the class are your design-cycle *Outputs*. You should try to create a very convincing presentation. After all, your freedom is on the line! A combination of good analysis, creativity, well-managed development, and engaging presentation skills will be required to create a successful product.

Feedback

Your classmates will give you *Feedback* on the accuracy and the overall appeal of your presentation based on the criteria of the design challenge. This *Feedback* will likely become part of your grade but could also be useful for additional design iterations. No design is perfect, because there is always room for optimization or improvement, no matter how slight. From your experience with the *Mini-Challenge* you should see how you could continuously rotate through the design cycle to refine almost any idea.

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performance by giving it a grade. You should emphasize that the feedback they receive from their classmates will help them in reassessing their *Goal* before its final presentation and it provides an opportunity to include additional ideas or redefine the existing elements of their several design iterations.