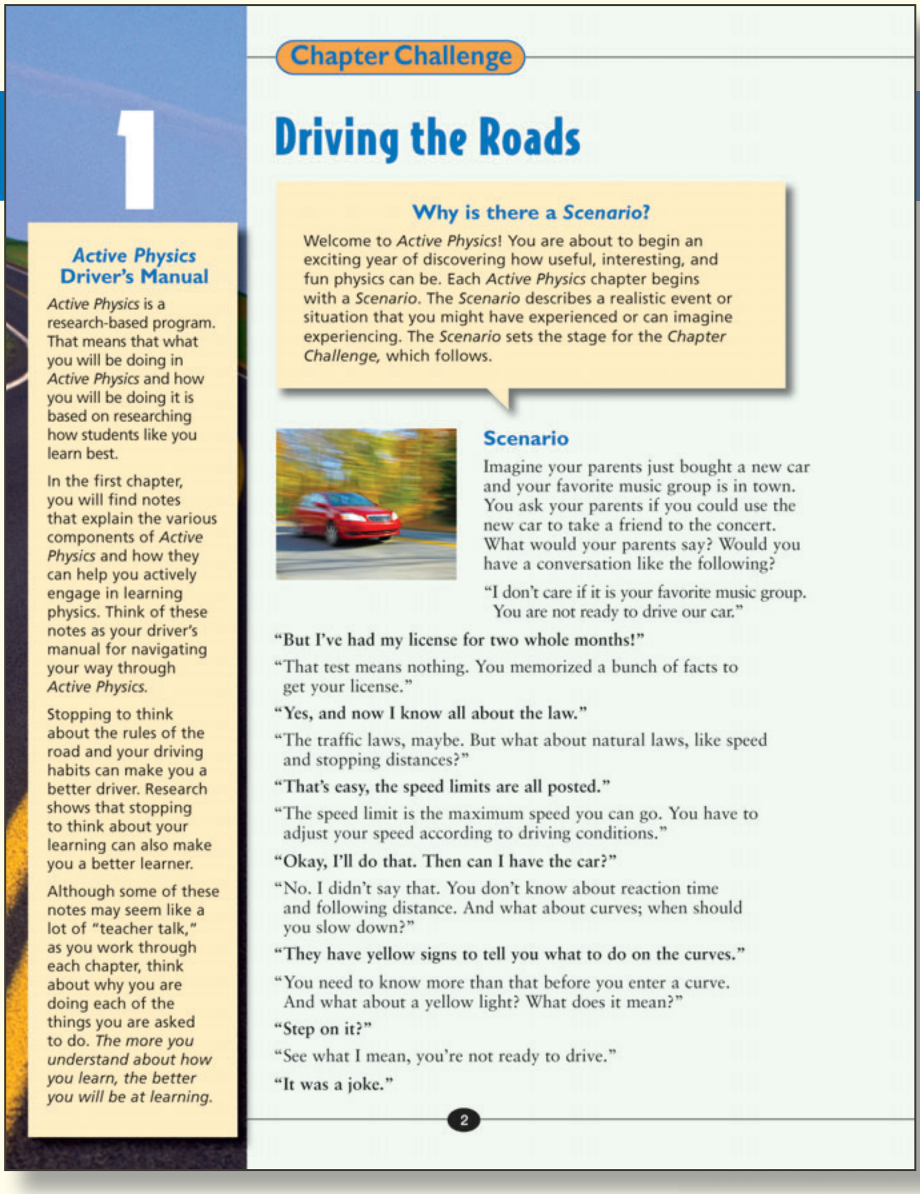
Chapter Challenge

Launcher Material

The first chapter in *Active Physics*, *Driving the Roads*, is a launcher chapter. In the first section of this chapter, students are introduced to the many features of *Active Physics*, as indicated in the manila colored call-out boxes. However, what is unique about this introduction is that it also explains to the students why each feature is included and how it will help them learn physics. Prefaced by the statement "The more you understand about how you learn, the better you will be at learning." encourages students to expand their metacognitive awareness.



1

Chapter Challenge

Driving the Roads

Active Physics Driver's Manual

Active Physics is a research-based program. That means that what you will be doing in *Active Physics* and how you will be doing it is based on researching how students like you learn best.

In the first chapter, you will find notes that explain the various components of *Active Physics* and how they can help you actively engage in learning physics. Think of these notes as your driver's manual for navigating your way through *Active Physics*.

Stopping to think about the rules of the road and your driving habits can make you a better driver. Research shows that stopping to think about your learning can also make you a better learner.

Although some of these notes may seem like a lot of "teacher talk," as you work through each chapter, think about why you are doing each of the things you are asked to do. *The more you understand about how you learn, the better you will be at learning.*

Why is there a *Scenario*?

Welcome to *Active Physics*! You are about to begin an exciting year of discovering how useful, interesting, and fun physics can be. Each *Active Physics* chapter begins with a *Scenario*. The *Scenario* describes a realistic event or situation that you might have experienced or can imagine experiencing. The *Scenario* sets the stage for the *Chapter Challenge*, which follows.

Scenario

Imagine your parents just bought a new car and your favorite music group is in town. You ask your parents if you could use the new car to take a friend to the concert. What would your parents say? Would you have a conversation like the following?

"I don't care if it is your favorite music group. You are not ready to drive our car."

"But I've had my license for two whole months!"

"That test means nothing. You memorized a bunch of facts to get your license."

"Yes, and now I know all about the law."

"The traffic laws, maybe. But what about natural laws, like speed and stopping distances?"

"That's easy, the speed limits are all posted."

"The speed limit is the maximum speed you can go. You have to adjust your speed according to driving conditions."

"Okay, I'll do that. Then can I have the car?"

"No. I didn't say that. You don't know about reaction time and following distance. And what about curves; when should you slow down?"

"They have yellow signs to tell you what to do on the curves."

"You need to know more than that before you enter a curve. And what about a yellow light? What does it mean?"

"Step on it?"

"See what I mean, you're not ready to drive."

"It was a joke."

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Scenario

You may wish to role-play the scene described in the *Scenario* using students as parents and teenage drivers. Ask them how they might try to convince their parents to let them borrow the new car, and how their parents might try to avoid giving it to them. Discuss how their knowledge of physics will help them convince their parents that they are safe drivers. You should encourage students to ask questions in class, and try to create a conversational atmosphere that builds on personal stories and shared experiences.

Keep the *Scenario* focused on the main topic by lightly touching on student answers that broaden their perspective on the importance of safety on the roads, and prompts them to defend their arguments with a reflective mind-set. You may want to invite a professional from a driving school or Department of Motor Vehicles in your area to highlight the importance of why students should be properly informed of the physics behind the rules and regulations of driving. Reassure them that while they may feel ill-prepared now to complete the *Chapter Challenge*, by the end of the chapter they will have the skills and vocabulary to respond adequately. Avoid providing students with too many examples of what could be done, as this may limit their creativity and confidence in seeking their own solutions.

"Driving is no joke. What if you have an accident? What then? What if your friend in the car distracts you?"

"I don't plan on an accident; besides, I'll always wear my seat belt."

"No one plans on an accident—that's why they're called accidents!"

"But I have a valid driver's license."

"Yes, but you still have a lot more to learn."

"You just don't love me."

"I'm doing this *because* I love you."

Why is there a *Chapter Challenge*?

At this point, you are presented with what you and your group members will be required to do as a chapter project. The *Chapter Challenge* may be a problem you are expected to solve or a task you are expected to complete using the knowledge you gain in the chapter. When you first encounter the *Chapter Challenge*, you may find it overwhelming. However, all the physics content in the chapter will help you succeed at the challenge. Each section will provide you with another piece of the puzzle that, when put together, will answer the challenge.

The *Chapter Challenge* is the glue that holds the chapter together. In *Active Physics*, you will never be left wondering, "Why am I learning this?" You will need everything you learn in a chapter to complete the *Chapter Challenge*. You can think of the challenge as the job you need to do over the next few weeks.

Your Challenge

Automobile insurance for most teenage drivers is carried on their parents' policy. Your automobile insurance company says that, if new drivers can pass a course from a certified driving academy, your automobile insurance rates will be reduced. So, before your parents allow you to drive, you must pass a driving course. You find, upon checking with Active Driving Academy—the only driving school in your area—that they enroll students in groups. You are told that, as part of Active Driving Academy's requirements, your group must demonstrate some basic knowledge of the physics of driving. You must demonstrate this knowledge through a two-to three-minute presentation to academy instructors. At a minimum, the presentation must explain the following:

- the relationships among 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 among speed, friction, and radius of the curve when turning.

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Your Challenge

Lead a class discussion about the *Chapter Challenge* and the expectations. You should clarify to the students that the presentation should have a written report with an advertisement, cartoon, or story. Students should be able to explain the main physics concepts in their presentation. It is important for you to emphasize that they enrich their presentation with visual aids. For example, students should be able to show the relationship between reaction distance, braking distance, and stopping distance; should consider what to do when the light turns yellow as they approach an intersection; and should be clear about the connection between speed, friction, and radius of the curve to determine a safe speed limit.

As the class progresses through the chapter, you will need to familiarize students with the content so they can connect the physics principles they learn to their *Chapter Challenge*. You have to keep reminding students that as the chapter unfolds, each new concept will build upon the other, giving them the tools to strengthen their presentation.

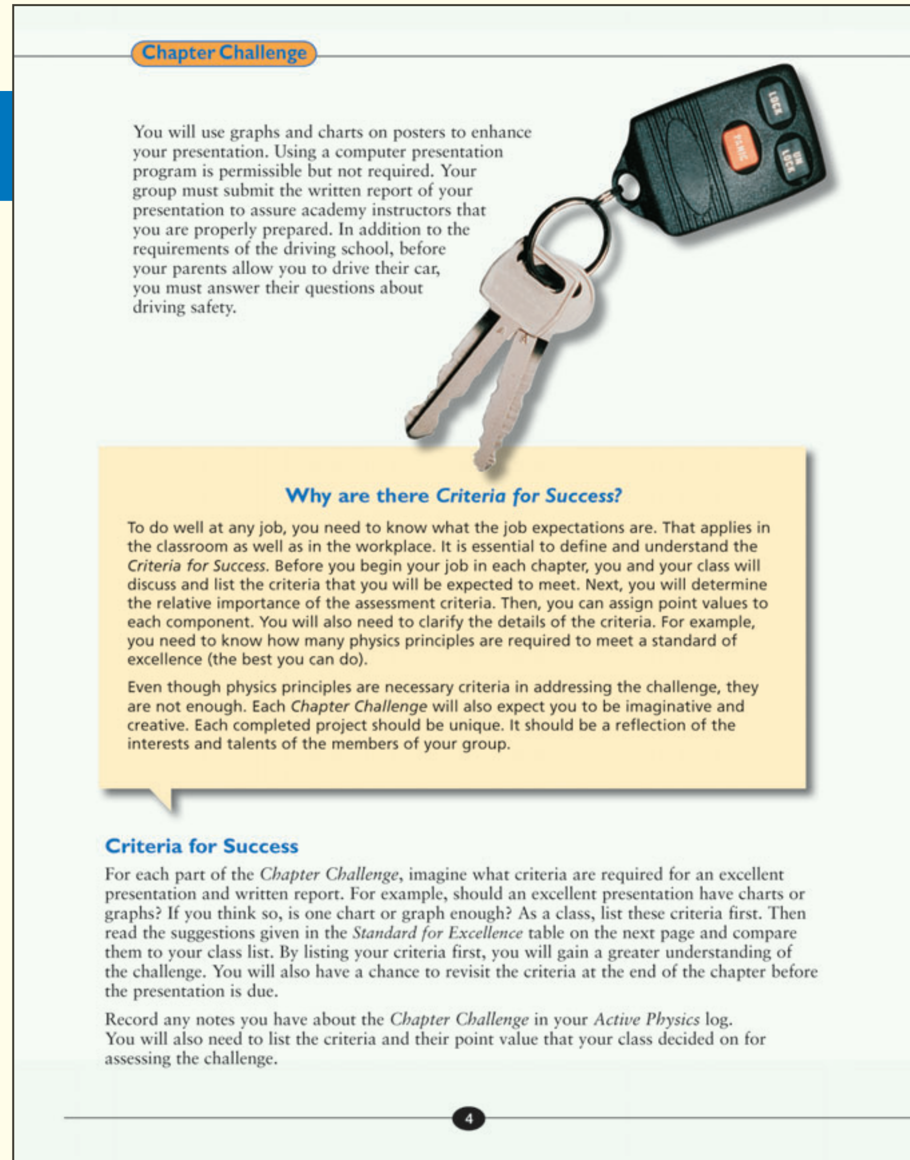
Chapter Challenge

Criteria for Success

Take a few moments with your class to develop the criteria for assessing the *Chapter Challenge*. Students should be asked, "What details must your presentation have for you to earn an A?" A way to get started is to make a list of important criteria that are required for the *Chapter Challenge*. List the relevant student suggestions by making frequent references to the physics principles that are likely to be considered.

The criteria should include accurate and clear explanations with original ideas. (It is important that all suggestions be recognized as students volunteer ideas, since this is essentially a brainstorming session.) By soliciting the students' opinions, each criterion should be written in a style that students can understand.

When you have a thorough description of each part of the *Chapter Challenge*, you can have the class vote on how much each part is worth. As students participate in choosing criteria for assessing their own work, they subsequently gain a better understanding of the *Chapter Challenge*.



Chapter Challenge

You will use graphs and charts on posters to enhance your presentation. Using a computer presentation program is permissible but not required. Your group must submit the written report of your presentation to assure academy instructors that you are properly prepared. In addition to the requirements of the driving school, before your parents allow you to drive their car, you must answer their questions about driving safety.

Why are there *Criteria for Success*?

To do well at any job, you need to know what the job expectations are. That applies in the classroom as well as in the workplace. It is essential to define and understand the *Criteria for Success*. Before you begin your job in each chapter, you and your class will discuss and list the criteria that you will be expected to meet. Next, you will determine the relative importance of the assessment criteria. Then, you can assign point values to each component. You will also need to clarify the details of the criteria. For example, you need to know how many physics principles are required to meet a standard of excellence (the best you can do).

Even though physics principles are necessary criteria in addressing the challenge, they are not enough. Each *Chapter Challenge* will also expect you to be imaginative and creative. Each completed project should be unique. It should be a reflection of the interests and talents of the members of your group.

Criteria for Success

For each part of the *Chapter Challenge*, imagine what criteria are required for an excellent presentation and written report. For example, should an excellent presentation have charts or graphs? If you think so, is one chart or graph enough? As a class, list these criteria first. Then read the suggestions given in the *Standard for Excellence* table on the next page and compare them to your class list. By listing your criteria first, you will gain a greater understanding of the challenge. You will also have a chance to revisit the criteria at the end of the chapter before the presentation is due.

Record any notes you have about the *Chapter Challenge* in your *Active Physics* log. You will also need to list the criteria and their point value that your class decided on for assessing the challenge.

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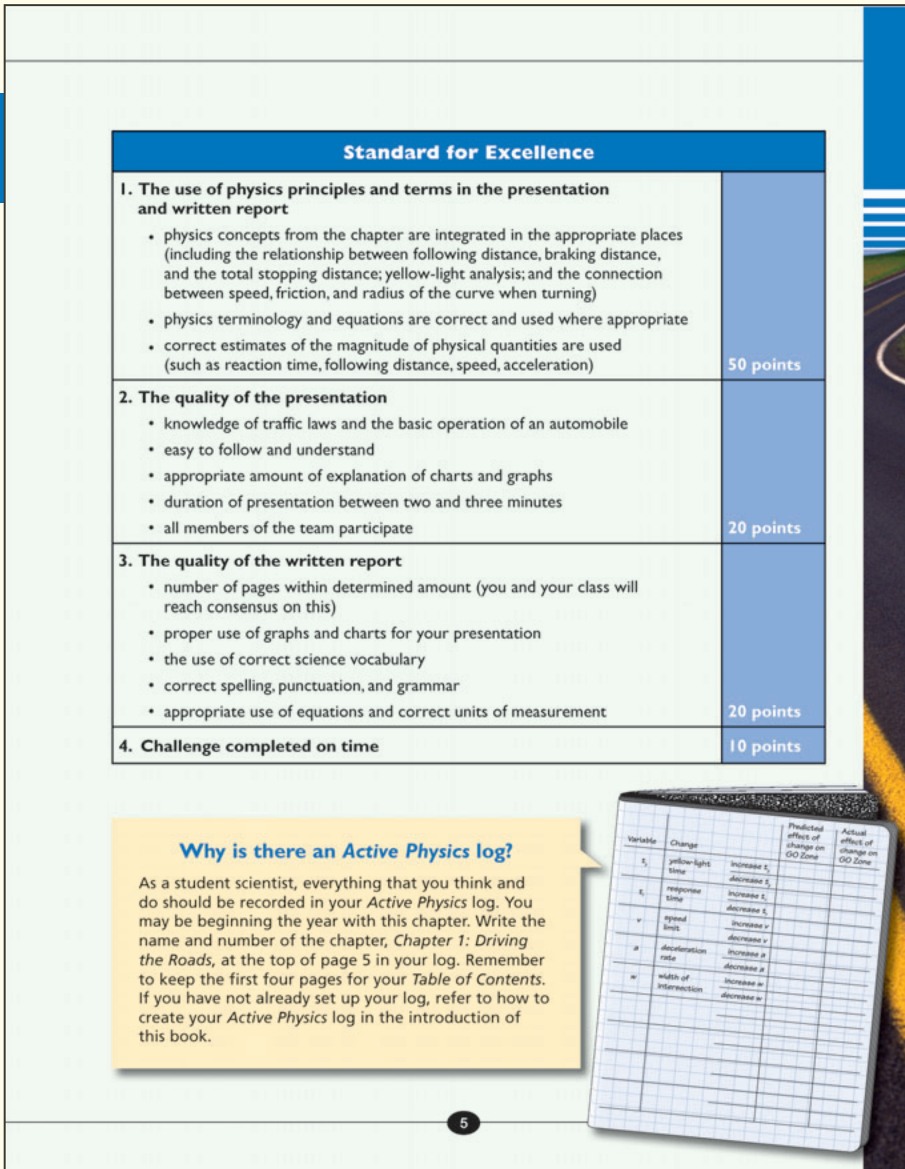
Read aloud the criteria that you and your students came up with for assessing the *Chapter Challenge*. The reading might bring up other interesting points that you could use to reinforce or modify the criteria.



Standard for Excellence	
1. The use of physics principles and terms in the presentation and written report • physics concepts from the chapter are integrated in the appropriate places (including the relationship between following distance, braking distance, and the total stopping distance; yellow-light analysis; and the connection between speed, friction, and radius of the curve when turning) • physics terminology and equations are correct and used where appropriate • correct estimates of the magnitude of physical quantities are used (such as reaction time, following distance, speed, acceleration)	50 points
2. The quality of the presentation • knowledge of traffic laws and the basic operation of an automobile • easy to follow and understand • appropriate amount of explanation of charts and graphs • duration of presentation between two and three minutes • all members of the team participate	20 points
3. The quality of the written report • number of pages within determined amount (you and your class will reach consensus on this) • proper use of graphs and charts for your presentation • the use of correct science vocabulary • correct spelling, punctuation, and grammar • appropriate use of equations and correct units of measurement	20 points
4. Challenge completed on time	10 points

Why is there an *Active Physics* log?

As a student scientist, everything that you think and do should be recorded in your *Active Physics* log. You may be beginning the year with this chapter. Write the name and number of the chapter, *Chapter 1: Driving the Roads*, at the top of page 5 in your log. Remember to keep the first four pages for your *Table of Contents*. If you have not already set up your log, refer to how to create your *Active Physics* log in the introduction of this book.

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A more comprehensive sample rubric for assessing the *Chapter Challenge* is provided at the end of this chapter in this volume of the *Teacher's Edition*. You could copy and distribute it, or use it as a template for developing scoring guidelines and expectations that suit the needs of your students. For example, you might wish to ensure that core concepts and abilities derived from your local or state science frameworks also appear in the rubric. However, if you decide to evaluate the *Chapter Challenge*, keep in mind that all expectations should be communicated to the students when they begin their work.

Remind students that the rubric can be modified as their understanding of concepts grows. The *Standard for Excellence* table is provided as a Blackline Master in your *Teacher Resources CD*.

1a **Blackline Master**

Standard for Excellence

Once the students have compiled a list of criteria, ask them to develop a rough rubric for grading the challenge. This can be as simple as ascribing points to each criterion. You may want to have students assign fewer points to certain components of the rubric. For instance, the quality of the visual presentation would have fewer points than the explanation of physics principles. The rubric should put greater emphasis on how an understanding of physics concepts is utilized in the presentation.

Criteria mentioned in the student text should be included in the rubric. The rubric would therefore cover different aspects of the challenge, such as the use of the physics principles, quality of the written report, and the quality of the visual presentation.

Chapter Challenge

Engineering Design Cycle

The *Engineering Design Cycle* is a sequence of steps used to solve problems. Discuss each step of this cycle. Emphasize that this process will continue as students keep learning and testing their understanding of new concepts. Divide students into five groups and give each group the task of determining the purpose of each step in the *Engineering Design Cycle.*

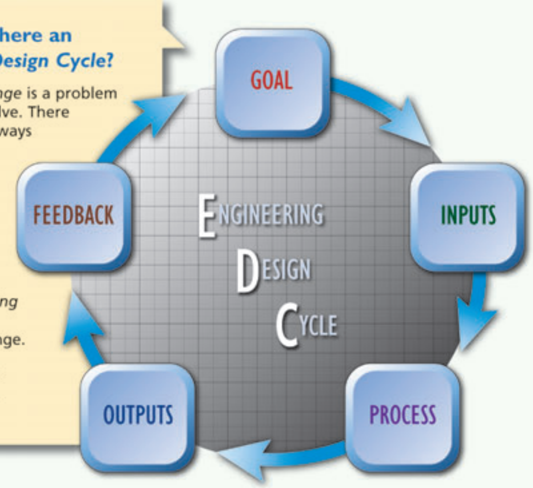
Ask students to discuss and write a brief summary in their *Active Physics* log, explaining the bulleted information given in the chart of the *Simplified Engineering Design Cycle.* Once students have finished writing the summary, have a representative from each group read aloud the explanation that each group member discussed and wrote down. As the student representative is reading his/her group's summary aloud, jot down important ideas on the board and initiate a whole-class discussion to allow all students to collectively participate and share in understanding the purpose of the *Engineering Design Cycle.*

1b Blackline Master

Chapter Challenge

Why is there an *Engineering Design Cycle?*

The *Chapter Challenge* is a problem that you need to solve. There are many different ways to solve problems. One sequence of steps that can be used to solve problems is called the *Engineering Design Cycle.* You are going to use a simplified *Engineering Design Cycle* as you address your challenge. There are five basic steps to a simplified engineering design.



Simplified Engineering Design Cycle	
GOAL	• define the problem • identify available resources • draft potential solutions • list constraints to possible actions
INPUTS	• complete the investigations in each section • learn new physics concepts and vocabulary
PROCESS	• evaluate work to date • compare and contrast methods and ideas • examine possible trade-offs to help reach goals and maximize efforts • create a model from your information • design experiments to test ideas and the suitability of the model
OUTPUTS	• present *Mini-Challenge* and intermediary steps or products • present *Chapter Challenge* based on feedback to *Mini-Challenge*
FEEDBACK	• obtain response from target audience leading to modification of the goal • identify additional constraints, requiring restarting the input and process stages

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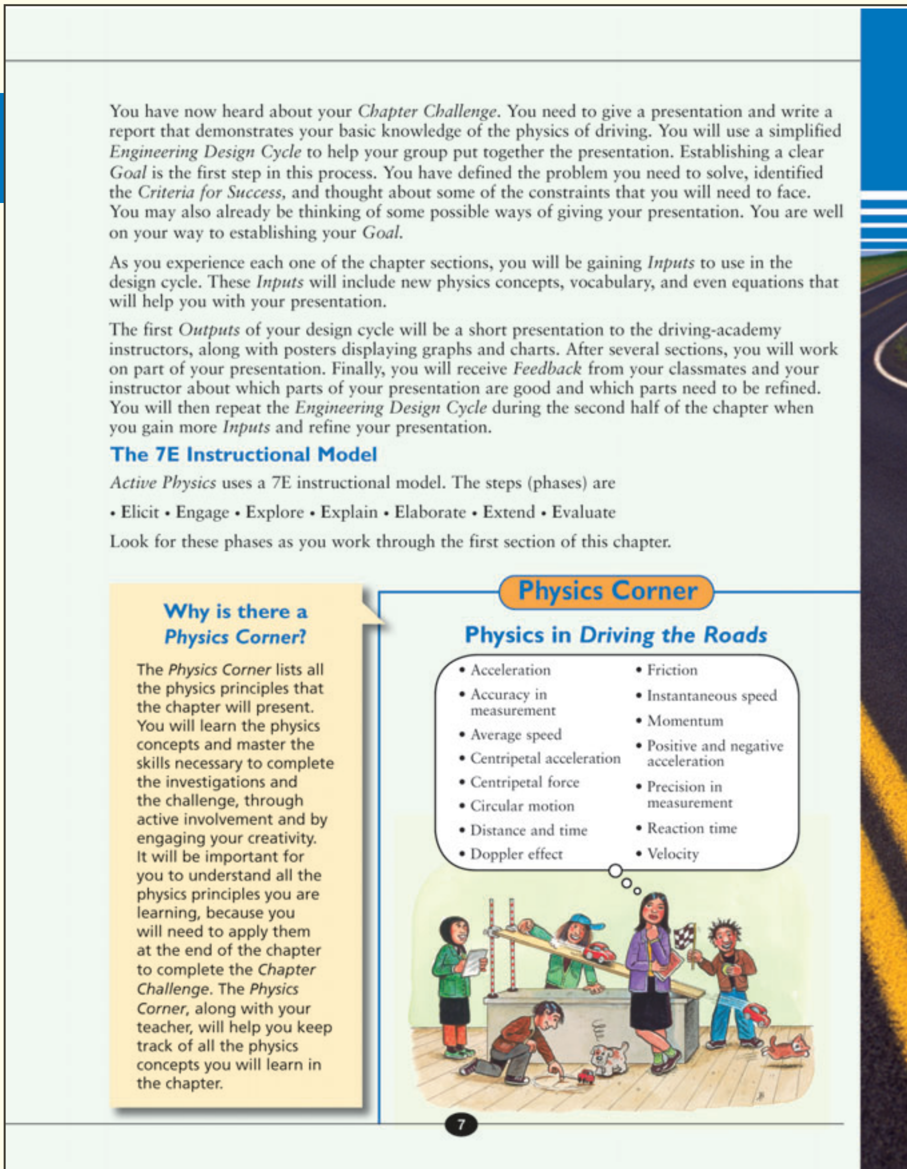

You have now heard about your *Chapter Challenge*. You need to give a presentation and write a report that demonstrates your basic knowledge of the physics of driving. You will use a simplified *Engineering Design Cycle* to help your group put together the presentation. Establishing a clear *Goal* is the first step in this process. You have defined the problem you need to solve, identified the *Criteria for Success*, and thought about some of the constraints that you will need to face. You may also already be thinking of some possible ways of giving your presentation. You are well on your way to establishing your *Goal*.

As you experience each one of the chapter sections, you will be gaining *Inputs* to use in the design cycle. These *Inputs* will include new physics concepts, vocabulary, and even equations that will help you with your presentation.

The first *Outputs* of your design cycle will be a short presentation to the driving-academy instructors, along with posters displaying graphs and charts. After several sections, you will work on part of your presentation. Finally, you will receive *Feedback* from your classmates and your instructor about which parts of your presentation are good and which parts need to be refined. You will then repeat the *Engineering Design Cycle* during the second half of the chapter when you gain more *Inputs* and refine your presentation.

The 7E Instructional Model

Active Physics uses a 7E instructional model. The steps (phases) are

• Elicit • Engage • Explore • Explain • Elaborate • Extend • Evaluate

Look for these phases as you work through the first section of this chapter.

Why is there a *Physics Corner*?

The *Physics Corner* lists all the physics principles that the chapter will present. You will learn the physics concepts and master the skills necessary to complete the investigations and the challenge, through active involvement and by engaging your creativity. It will be important for you to understand all the physics principles you are learning, because you will need to apply them at the end of the chapter to complete the *Chapter Challenge*. The *Physics Corner*, along with your teacher, will help you keep track of all the physics concepts you will learn in the chapter.

Physics Corner

Physics in *Driving the Roads*

- Acceleration
- Accuracy in measurement
- Average speed
- Centripetal acceleration
- Centripetal force
- Circular motion
- Distance and time
- Doppler effect
- Friction
- Instantaneous speed
- Momentum
- Positive and negative acceleration
- Precision in measurement
- Reaction time
- Velocity

7

Physics Corner

The *Physics Corner* illustrates the physics concepts that students are required to learn. This section provides a quick preview of all the physics concepts that will be presented in the chapter. Ask your students if they are familiar with any of the concepts they are about to study and encourage them to provide definitions for the terms they already know. Remind them that the study of these concepts will help them in writing their report, and they will be able to enhance their presentation as they make meaningful connections between concepts.

You will find students motivated by actively engaging in the learning process. As the *Chapter Challenge* approaches, review the *Physics Corner* to help them keep track of all the physics concepts they have learned.

CHAPTER 1

SECTION 1

Reaction Time: Responding To Road Hazards

Section Overview

This section addresses questions of reaction time in relation to bringing a vehicle to rest. Students conduct experiments to measure their reaction time, first in the absence and, later, in the presence of distractions. They estimate how long it would take them to move their foot between imaginary gas and brake pedals. Students also investigate one of two methods to see how reaction time varies in different situations. As lab partners, they record the difference in the time it takes them to turn off their stopwatches or catch a dropped ruler. They then make a list of activities that distract them while driving and simulate those distractions.

Background Information

Background Information for most sections is provided for the interest and insight of the teacher only. It is not intended to be part of the classroom instruction. Reaction time can be understood by grouping physiological processes into three categories: input of sensory information, coordination by the central nervous system, and the response by motor nerves and their effectors, muscles, and/or glands. The simplest reaction pathway is that of a reflex arc. Sensory receptors identify environmental stimuli, causing a sensory nerve cell to become excited. The sensory nerve cell transmits an electrochemical impulse to the spinal cord. Here an intermediary nerve cell transmits a sensory impulse to a motor nerve cell. The impulse is carried by the motor nerve cell to a muscle (or in some cases a gland). The contraction of the muscle signals the response. A knee-jerk response provides an excellent example of this simple nerve pathway. The impulse is triggered through three nerve cells: sensory, interneuron, and motor nerve that travels toward the muscle. Surprisingly, no integration is required by the brain. These reactions occur without thinking.

Reactions that require integration by the central nervous system, such as those that occur when driving, take considerably longer to occur. A moose running in front of a vehicle is identified by visual receptors within the eye. Sensory impulses are carried toward the brain by the optic nerve. Here the information is accumulated and the driver is made aware of the problem. Multiple nerve connections carry the impulses toward the motor area of the brain. A conscious decision is made to lift the foot from the accelerator pedal and push down on the brake. Because the sensory nerves are connected with motor nerves through a maze of circuits within the brain, the reaction time is much longer than that of a reflex arc. Each time an impulse passes between connecting nerve cells, the speed of transmission is slowed.

Conscious decisions, such as braking for a moose, depend upon a number of variables. The time it takes to catch sight of the moose may well be the largest variable. Any distraction or driver fatigue will increase reaction time. Most impulses travel at approximately 100 m/s along a nerve cell, but the time required for the impulse to travel between two different nerve cells varies greatly.

Transmitter chemicals diffuse between connecting nerve cells. Because diffusion takes much more time than the movement of an impulse along a nerve cell, the connections between nerve cells slows reaction time. Not surprisingly, the complexity of integration of sensory impulses by the brain to create a visual image and the number of nerve cells involved also affects reaction time. The greater the number of interconnecting nerves, the slower is the processing time. Moving images require greater time to process and interpret than still images. To accurately determine reaction times, you must consider how the reaction time is measured. The removal of the foot from the driver's pedal takes considerably more time than just pushing down on the brake. The distance the leg moves, the amount of muscle required, and the health of the muscle also affect reaction rates.

The reaction time graph is created by using the following equation for free-fall motion:

$$d = \frac{1}{2}at^2$$

where a is the acceleration due to gravity (9.8 m/s^2), t is the elapsed time, and d is the distance fallen.

Because all objects fall at the same rate, there is no need to be concerned with the mass of the ruler.

Solving the free-fall equation for time:

$$t = \sqrt{\frac{2d}{a}}$$

allows you to compute the reaction time for any given distance. The students will be introduced to this equation later in the course. To provide the equation with no evidence of constant acceleration would not help their understanding at this point. If, on the other hand, they have studied acceleration previously, you may use this equation to provide a reinforcement of this concept.

As people age, reaction rates are said to decline. The buildup of pigmented Nissl bodies within nerve cells slows the transmission of nerve impulses. In addition, the production of transmitter chemicals, the things that allow impulses to travel between nerves, decreases with age. Older people also tend to have less healthy muscles, further increasing the time it takes to respond to a stimulus. But age is not the major factor when considering reaction rates. The alertness of the driver is far more important.

NOTES

Crucial Physics

- A person has measurable reaction time.
  - The reaction time is affected by distractions.
  - Reaction time without distractions is approximately 0.1 s.
- Poor reaction time can lead to more accidents.
- Driving while intoxicated (DWI) is dangerous because of the effect of alcohol on reaction times.

Learning Outcomes	Location in the Section	Evidence of Understanding
Measure reaction time using one of two different methods.	***Investigate*** Method A OR Method B	Students measure the difference between reaction times on each stopwatch or record how long it takes to stop a ruler from falling, or use a reaction-time meter to record reaction times for each method.
Compare the different methods of measuring reaction time.	***Investigate*** Comparing Methods of Reaction Time: Step 1.a) *and* Step 1.c)	Students compare reaction-time measurements from each method to determine which method is most accurate.
Compare the reaction times of your classmates.	***Investigate*** Comparing Methods of Reaction Time: Step 2.a)	Students compare reaction-time measurements with their classmates and record their answers.
Investigate how distractions affect reaction time.	***Investigate*** Reaction Time with Distractions: Steps 1.a)-2.a)	Students explore how distractions affect reaction time when they have to make a decision while driving.

NOTES

Section 1 Materials, Preparation, and Safety

Materials and Equipment

PLAN A		
Materials and Equipment	**Group (4 students)**	**Class**
Stopwatch	2 per group	
Ruler, metric, 30 cm	1 per group	

*Additional items needed not supplied

PLAN B		
Materials and Equipment	**Group (4 students)**	**Class**
Stopwatch	2 per group	
Ruler, metric, 30 cm	1 per group	

*Additional items needed not supplied

Note: Time, Preparation, and Safety requirements are based on Plan A, if using Plan B, please adjust accordingly.

Time Requirement

Approximately 40 minutes are required to complete the experiment.

Teacher Preparation

- Reaction-time software in the form of a spreadsheet game is available from *It's About Time* as an alternative method of testing the students.
- Be sure that stopwatches are counted at the end of the class to ensure that all are returned.

Safety Requirements

- No particular safety precautions are required; however, students should be careful when dropping the rulers to test their reaction times. Rulers should be dropped in areas where they cannot bounce up toward any students' eyes if they are not caught before falling to the floor or table.

CHAPTER 1

Meeting the Needs of All Students

Differentiated Instruction: Augmentation and Accommodations

Learning Issue	Reference	Augmentation and Accommodations
Understanding the purpose of an *Investigate*	***Learning Outcomes***	**Augmentation** • Students often complete investigations in discrete steps that do not seem to be connected to a common goal. This makes it much more difficult to analyze results, draw conclusions, and make meaning from new learning. Explicitly review the *Learning Outcomes* at the beginning of each section to set a purpose and make students aware of the big picture.
Using a textbook as a learning tool	***"Why is there…?"***	**Augmentation** • Some students do not know how to use their textbooks to assist them in their learning process. Read the section explanations in large or small groups. Have a class discussion about the purpose of each section. Small groups could also make posters to represent the purpose of each section and then present them to the whole class. • Display the posters in the classroom.
Following directions and collecting data independently	***Investigate***	**Augmentation** • Many students have a difficult time following the different steps of an *Investigate* because of focus issues and reading comprehension deficits. Instruct students to focus on one step at a time and record their observation. • Set time limits for tasks to give verbal and written time reminders. For example, if students are given 25 minutes to complete the Investigate: Methods A and B, start a timer and give five-minute reminders to keep students on task. Check in with students, especially at the beginning of the investigation, to make sure they understand the directions and are staying on task. **Accommodation** • Provide students with an observation chart to ensure that students record the appropriate data for each step. • Pair students strategically in groups of two to compensate for reading and focus issues. Students who have a difficult time focusing work better when accountable to only one partner.
Estimating reaction times	***Investigate*** Steps 1-2	**Augmentation** • Many students struggle with making sense of numbers in estimating reaction times. Provide students with reasonable examples of reaction times (seconds are more reasonable than minutes).
Visual-motor integration	***Investigate*** Method B	**Augmentation** • Some students will not be able to respond quickly enough to catch a ruler before it falls. Use a meter stick, or something else that is long enough, for students with poor hand-eye coordination.
Calculating an average	***Investigate*** Comparing Methods of Measuring Reaction Time: Step 2.a) ***Investigate*** Reaction Time with Distractions	**Augmentation** • Provide direct instruction on how to calculate an average or mean. Model the procedure for measuring "reaction time with distractions" using a pair of students. Use the data collected from this procedure to review averages.

Learning Issue	Reference	Augmentation and Accommodations
Generalizing data to draw conclusions Number concepts	***Investigate*** Comparing Methods of Measuring Reaction Time	**Augmentation** • Students are asked to compare numbers that may have values with decimals, and the task might be conceptually difficult to determine fastest, slowest, and average reaction times. Provide direct instruction to teach place values of decimal numbers. Using money is a good way to teach this concept. (Five cents = $0.05, 10 cents = $0.10, etc.) **Accommodation** • Provide students with a number line that has a range of increasing decimal values.

Strategies for Students with Limited English-Language Proficiency

Learning Issue	Reference	Augmentation
Vocabulary comprehension	***Investigate*** Introduction	ELL students may need support for understanding the grammar of how "the *Investigate*" is used in the textbook. A student may be confused when a term they recognize as a verb is used as a noun. Point out that "the" is one clue, and the italic type is another clue, that this phrase is being used as a noun. Help students with the word "distraction." Explain that it is a combination of the base word "traction," meaning "the condition of being pulled," and the prefix "dis," meaning "apart" or "remove." In context, a distraction is something that "pulls your attention apart" from the task at hand.
Vocabulary comprehension Background knowledge	***Investigate*** Reaction Time with Distractions, Steps 1, 2.b)	Students may need support for using the term "experiment," which can be a verb or a noun. It may help to have students think of simpler terms, such as "clean" or "pump," that can be both verbs and nouns. Encourage ELL students to share their lists of 10 driving distractions with the class. They will benefit from the opportunity to speak, and all students will benefit from hearing of distractions they may not have considered.
Vocabulary comprehension	***Physics Talk*** Reaction Time and Distractions	Students may not be familiar with the nuance of "collision," meaning an accident in which two or more vehicles are involved. In physics, a collision can occur between a moving object and a stationary object, but in common usage a car hitting a tree would not be considered a collision.
Understanding concepts	***Physics Talk*** Other Factors Affecting Reaction Time	It is almost certain that all students will take medication at some point in their lives. Also, many over-the-counter medicines, such as some cough syrups, warn of possible drowsiness, which can interfere with reaction time. Given the relevance to their lives, students may benefit from a discussion of the alcohol and drug paragraph.
Vocabulary comprehension	***Reflecting on the Section and the Challenge***	Students may need help with the slang term "rubbernecking." It may help to have students explain why having a "rubber neck" would aptly describe people taking their eyes off the road to look at an accident or another unusual occurrence.