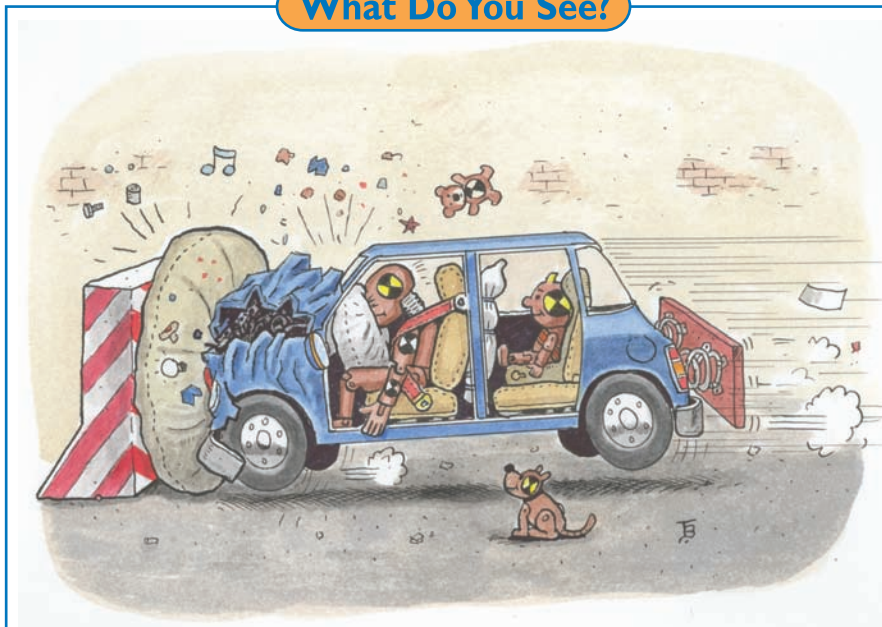




Section 1

Accidents

What Do You See?



Learning Outcomes

In this section, you will

- **Evaluate** your understanding of safety.
- **Identify** and evaluate safety features in selected automobiles.
- **Compare** and contrast the safety features in selected automobiles.
- **Identify** safety features required for other modes of transportation (in-line skates, skateboards, bicycles).

What Do You Think?

Chances are that you will be in an accident one day involving some means of transportation, such as an automobile, in-line skates, or bicycle.

- **How can you protect yourself from serious injury should an accident occur?**

Record your ideas about this question in your *Active Physics* log. Be prepared to discuss your response with your small group and the class.

Investigate

In this section, you will test your knowledge of the risks involved in vehicle collisions. You will also investigate some of the safety features available in vehicles built after 1960.

1. Many people think that they know the risks involved with day-to-day transportation. The “test” on the next page will check your knowledge of these risks.

The statements are organized in a true and false format. Record a T in your log for each statement you believe is true and an F if you believe the statement is false. Your teacher will supply the correct answers, based on statistics, at the end of the section.

- a) More people die of cancer than in automobile accidents.
 - b) Your chances of surviving a collision improve if you are thrown from the automobile.
 - c) The fatality rate in motorcycle accidents is less than in automobiles.
 - d) A large number of people who wear seat belts are killed in a burning or submerged automobile.
 - e) If you do not have a child restraint seat, you should place the child in your seat belt with you.
 - f) You can react fast enough during an accident to brace yourself against the impact of the collision.
 - g) Most people die in traffic accidents during long trips.
 - h) A person not wearing a seat belt in your vehicle poses a hazard to you.
 - i) Traffic accidents occur most often on Monday mornings.
 - j) Male drivers between the ages of 16 and 19 are most likely to be involved in traffic accidents.
 - k) Automobile accidents resulting in casualties are most frequent during the winter months due to snow and ice.
 - l) More pedestrians than drivers are killed by automobiles.
 - m) The greatest number of roadway fatalities can be attributed to poor driving conditions.
 - n) The greatest number of females involved in traffic accidents are between the ages of 16 and 20.
 - o) Unrestrained occupant casualties are more likely to be young adults between the ages of 16 and 19.
2. Calculate your score. Give yourself one point for a correct answer. You might want to match your score against the descriptors given below.
- 14-15 points: Expert Analyst
 11-13 points: Assistant Analyst
 8-10 points: Novice Analyst
 7 points and below: Myth Believer
- a) Record your score in your log. Were you surprised about the extent of your knowledge? Some of the reasons behind these facts will be better understood as you continue through this chapter.
3. Look at the photographs of two automobiles. One was built prior to 1960 and the other was built after 2000.





Safety features you may find in an automobile are listed in the first column of the following table. Explain why each safety feature may protect the driver, a passenger, or a pedestrian during an accident. You will record this in the second column in a table in your log. In the third column, state whether you think that the

safety feature was present in most pre-1960 automobiles (yes/no). In the fourth column, state whether the safety features are in all new automobiles (1), in some new automobiles (2), or in very few new automobiles, (3).

 a) Copy and complete the table in your log.

Safety features	Means of protection	Pre-1960 automobiles (y/n)	New automobiles (1,2,3)
seat belts			
head restraints			
front airbags			
back-up sensing system			
front crumple zones			
rear crumple zones			
side-impact beams in doors			
shoulder belts for all seats			
anti-lock braking systems (ABS)			
tempered shatterproof glass			
side airbags			
turn signals			
electronic stability control			
energy-absorbing collapsible steering column			

Physics Talk

VEHICLE SAFETY

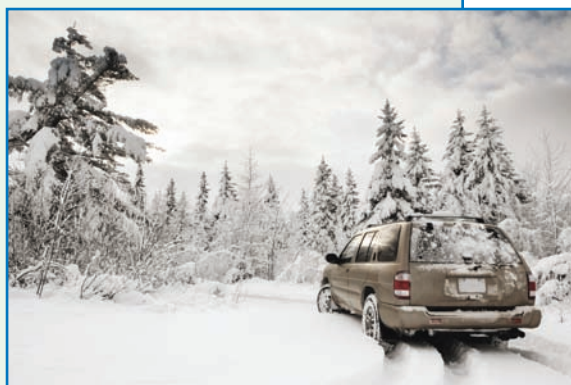
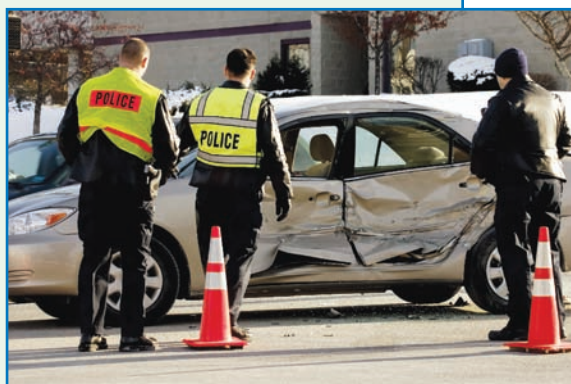
Nobody expects to be in an automobile accident. But accidents do occur. You may have already studied ways to avoid being involved in automobile accidents. In this chapter, you will investigate the systems in vehicles that are designed to keep you safe in case of a collision.

Governments and manufacturers of automobiles can work together to make vehicles safer. If you are in an accident in a safer vehicle, the chances of injury will be limited. People in vehicles are not the only ones in danger. A pedestrian can get hit by an automobile. Engineers can try to build the automobile so that pedestrians may be safer if they are hit by an automobile.

Safety was not always a major consideration in automotive manufacturing. A turning point in the history of automobile safety occurred when Ralph Nader, an American attorney and political activist, wrote the book *Unsafe at Any Speed* in 1965. This book highlighted the problems of not having seat belts in vehicles, having hard chrome dashboards, and solid steering columns. Since then, all automobile manufacturers have improved the safety of their vehicles.

An interesting Australian study of four-wheel drive (4WD) vehicles found that the incidence of fatal 4WD crashes increased by 85 percent between 1990 and 1998 (up 28 percent between 1994 and 1998). By comparison, the incidence of all fatal crashes decreased by 25 percent between 1990 and 1998 (down 10 percent between 1994 and 1998). There are two competing explanations for this. This increase in fatal 4WD crashes could be due to the growing number of kilometers traveled by 4WDs.

It could also be due to the tendency of some drivers to increase speed under the impression that the safety features will protect them. Automobiles with anti-lock brakes and four-wheel drive should be safer than automobiles without these features. Some drivers may overcompensate for these added features and end up in accidents that could have been avoided if they had just slowed down.



Checking Up

1. List three ways that manufacturers have made vehicles safer since the 1960s.
2. What are two explanations for the increase in fatal 4WD crashes?



What Do You Think Now?

At the beginning of this section, you were asked

- How can you protect yourself from serious injury should an accident occur?

In light of all the safety features you have investigated so far, how would you protect yourself in the event of an accident? What safety device do you think is most effective and why? What actions will not protect you in an accident?

Physics

Essential Questions

What does it mean?

Automobiles today have improved safety devices over older models. Describe three safety features of an automobile and explain how each feature provides passenger safety.

How do you know?

How do you know that safety has become a concern for automobile manufacturers?

Why do you believe?

Connects with Other Physics Content	Fits with Big Ideas in Science	Meets Physics Requirements
Forces and motion	Conservation laws	* Good clear explanation, no more complicated than necessary

- * The laws of physics do not change from day to day. Auto manufacturers add safety devices to automobiles in anticipation of accidents occurring. Compare bicycle helmet laws with laws of physics.

Why should you care?

Safer automobiles can reduce injuries to drivers, passengers, and pedestrians in the event of an accident. How is minimizing injuries in transportation accidents beneficial to society?

Reflecting on the Section and the Challenge

Automobile accidents can cause serious injuries in a number of different ways. If there are no restraints or safety devices in a vehicle, or if the vehicle is not constructed to absorb any of the energy of the collision, even a minor collision can cause serious injury. Until the early 1960s, automobile design and construction did not even consider passenger safety.

The general belief was that a heavy automobile was a safe automobile. While there is some truth to that statement, today's lighter automobiles may be safer than some of the large, heavy automobiles of the past.

In completing the *Chapter Challenge*, you will want to discuss which safety concerns you are addressing in your improved safety device, and the physics behind each improvement.

Physics to Go

- Review and list 10 safety features found in today's new automobiles. As you compile your list, write next to each safety feature one or more of the following designations:
 F—effective in a front-end collision.
 R—effective in a rear-end collision.
 S—effective in a collision where the automobile is struck on the side.
 T—effective when the automobile rolls over or turns over onto its roof.
- Make a list of safety features that could be used for bicycling.
- Make a list of safety features that could be used for in-line skating.
- Make a list of safety features that could be used for skateboarding.
- What safety features do you think should be in every automobile used today?
- Ask family members or friends if you may evaluate the safety of their automobile. Discuss and explain your evaluation to the automobile owners. Record your evaluation and their response in your log.
- Preparing for the Chapter Challenge*
 The safety survey may have provided you ideas for constructing a prototype of a safety system used for transportation. In your log, record ideas that have been generated from this section.

Inquiring Further

1. Safety and sales

Interview a salesperson of automobiles or bicycles, or collect brochures from various automobile and bicycle manufacturers. What new safety features are presented by the salesperson or in the brochures? How much of the advertising is devoted to safety?

2. Vehicle safety ratings

Do an Internet search for automobile safety features and ratings. You may wish to visit the National Highway Traffic Safety Administration Web Site. Compare vehicles from different categories, such as vans, sports cars, or pickup trucks.