Issue 45

Accelerated Motion Equations and Highway Safety

During the 1973 energy crisis, federal law mandated a reduction of the speed limit from 65 mi/hr to 55 mi/hr on the nation's highways to save gasoline. The accelerated motion equation:

$$v^2 = 2as$$

provides one of the reasons why the annual death toll went down by 27 percent.

The equation says that if you go twice as fast (v doubles), it takes your car *four* times as much distance *(s)* in which to stop. Conversely, if you slow down from 65 mi/hr to 55 mi/hr (0.85 times as fast), you can stop in 0.72 (or less than three-quarters) as great a distance. The difference saves lives.

In April 1987, the federal government gave each state the power to raise the speed limit from 55 mi/hr to 65 mi/hr on its rural interstate highways. The National Research Council reports that if this increase takes place nationwide, it will cause 2000 to 3000 additional traffic deaths annually.

Imagine you are a member of your state legislature, voting on whether to raise the speed limit. Knowing the cost in lives, which way would you vote?

Note that approximately 45,000 Americans are killed every year in automobile-related accidents. That is roughly equivalent to one fully loaded passenger airplane crashing each day.

Do you approve of motorists using radar detectors ("fuzz busters") to frustrate highway police speed control?

Should the use of automobile seat belts be mandatory?

While lower speeds save lives, seat belts save lives too. When a car going 80 km/hr (50 mi/hr) hits a wall, the car stops in about 0.16 sec. But the humans inside it (if they are not wearing seat belts) keep going at 80 km/hr and collide with the inside of the car 0.03 sec later. This second collision is equivalent to diving from a third-floor window head first with only your arms available to stop your fall at the bottom. Is it true that "speed kills"?

Experience with airplane crashes shows that lives could be saved if the seats, instead of facing forward, face the rear of the plane. This arrangement would make maximum use of seat padding and head support. The view out the window at 3050 meters (10,000 feet) would hardly be changed. In what ways would this change be good or bad physics? Good or bad for business?

The kinetic energy equation, K.E. = $mv^2/2$, says that at 10 times the speed a collision can do *100* times the damage. Compare the damage from hitting a big tree when jogging at 10 km/hr (about 6 mi/hr) with the damage when driving at 100 km/hr (about 60 mi/hr).

(See "Newton's Second Law ($F = ma$) in Athletics," p. 73.)

Think about this . . . *Wealthy people can afford to pay for heart transplants, so Medicare or Medicaid funds should be available to pay for heart transplants for only those who are poor. Do you agree?*