



Lesson 5: Calculation Fest

The analysis of vehicle crashes requires a wealth of physics calculations to fully understand the collision dynamics. Force, acceleration, energy, and momentum are just a few of the factors that impact the outcome of a crash. Get out your calculator and use your best physics skills to analyze vehicle crashes.

Doing the Science

1. Start the Car Crash Simulation.
2. Select the blue SUV on the left side of the screen.
3. Select the “Stiff” crush zone stiffness.
4. Select the “Short” crush zone length.
5. Select the “Crash Center” button at the bottom of the screen.
6. Select the “55 MPH” speed, and then select the “Crash It” button.
7. Note and record in Table 1 the average acceleration and crash duration for the crash.
8. Select the “New Vehicle” button at the bottom of the screen.
9. Repeat steps 3–7, except choose the red car on the right side of the screen.

Table 1. Acceleration and Crash Duration

Vehicle Type	Average Acceleration (g's)	Crash Duration (seconds)
Blue SUV		
Red Car		

Do You Understand?

1. Convert the 55 MPH vehicle speed to meters/second.

2. Convert the average acceleration (in g's) for both the blue SUV and red car into meters/second².

3. Assuming the mass of the blue SUV is 1,950 kilograms and the mass of the red car is 1,250 kilograms, find the force in newtons that each vehicle exerts on the collision barrier.

4. If the mass of the collision barrier is 145,000 kilograms, what force did the barrier exert on the blue SUV when the vehicle hit the barrier?

5. If the mass of the collision barrier is 145,000 kilograms, what average acceleration (in m/s^2) did the barrier experience during the collision with the blue SUV?

6. If the red car's mass is 1,250 kilograms, how much kinetic energy (in joules) did the red car have as it struck the barrier?

7. If a 65-kilogram passenger in the front seat of the red car was unrestrained at the time of the 55 MPH collision:
 - a. with what force (in newtons) would the passenger collide with the dashboard?

 - b. with what force (in pounds) would the passenger collide with the dashboard?

8. A green vehicle (mass = 1,700 kg) was traveling at a speed of 10.00 meters/second due north. A purple vehicle was traveling due south at a speed of 25.00 meters/second. The vehicles have a head-on collision. As a result of the collision, the green vehicle reverses its direction and moves at 5.00 meters/second. The purple vehicle continues traveling due south at a speed of 3.75 meters/second. What is the mass of the purple vehicle?