8.0: Overview

Up to this point in this text we have concentrated on analyzing interacting physical systems with a “before and after the interaction” approach. The defining characteristic of this approach is that we need to know only *net changes* that occur in various quantities as the result of interactions. We do not need to know the details of what took place between the initial and final times. What makes this such a powerful approach is that there exist very general conservation laws for energy, momentum, and angular momentum. If all interactions are included in the definition of the physical system (making it a closed system), then the total energy, momentum, and angular momentum of this total system remain constant, regardless of how the energy, momentum, and angular momentum of various parts of the system change. On the other hand, if we don’t include all interactions in our definition of the physical system (making it an open system), then the net change in these quantities is due to the energy, momentum, and angular momentum transferred into the system from outside. In the case of energy this transfer can occur as heat or work. For momentum, the transfer occurs as an impulse. For angular momentum, the transfer occurs as an angular impulse.

In this chapter we take a different approach. We focus on the details of what happens during interactions, not just at net changes that occur as a result of interactions. We explicitly look at the time-dependence of the change of various parameters. Work, impulse, and angular impulse all involve the net force that acts on the physical system. Consequently, we have already spent considerable time in the last two chapters learning how to work with forces to determine work and impulse. In the last chapter we also developed greater skill at describing motion. We will need to augment this knowledge of force and motion only slightly in this chapter to develop an approach that lets us predict the detailed time dependence of motion from a knowledge of the net force and vice versa.