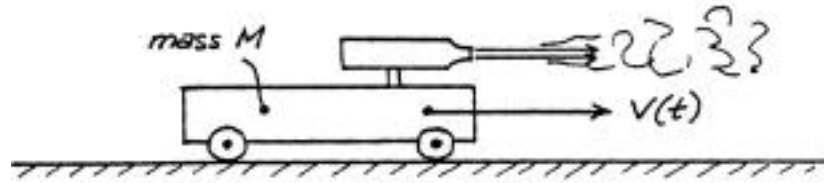# Problem 5.16
Rocket assisted braking

A high-speed test vehicle with initial velocity V_0 is to be brought quickly to rest on level ground by firing a rocket in the direction of motion. The rocket burns solid propellant at a mass rate $\dot{m}_R$ (kg/s) and ejects gas at a speed V_e relative to itself. The total mass of propellant burned during the rocket firing is small compared with the initial mass M of the system as a whole.

Given : M, V_0, $\dot{m}_R$, V_e.

Neglecting friction between the wheels and the ground and air drag, obtain an expression for the duration t_0 that the rocket must be fired in order to bring the vehicle to rest. For simplicity, assume that the pressure at the rocket exit is atmospheric. This may not be realistic if the rocket exhausts gases at near-sonic or supersonic speed.

Think also about related issues: What is the maximum deceleration during braking, in units of g? What is the braking distance?

HINT   HINT 2   ANSWER