Name _____ Date_____

Academic Activity Chapter 2 Determining a Constraint Mathematically

Research is one of an engineer's first tasks when he or she starts a new project. For this activity, you will research the physics of an Estes Super Alpha model rocket. Using the information you gather, you will then determine the basic mass characteristics needed to design a model rocket that will travel at exactly 200 mph at burnout using an Estes C6-5 rocket motor.

The Estes Super Alpha has a length of 42.5 cm, a diameter of 4.2 cm, and a mass of 62.5g or 0.0625 kg without the engine. The Estes C6-5 model rocket engine has an average mass of 25g or 0.025kg, a thrust of 6 Newtons per second, and a burn time of 1.6 seconds.

Physics concepts:

Force × change in time = impulse
Usually written $I = F\Delta t$
Impulse has units of kg(m/s)

mass × change in velocity = momentum
Usually written $p = m\Delta v$
Momentum has units of kg(m/s)

If the units are the same, we can set them against each other as equal to one another and derive the equation:

Momentum = Impulse
$m\Delta v = F\Delta t$

Use the equation to calculate the change in velocity from lift off to burn out of an Estes Super Alpha model rocket launched on an Estes C6-5 model rocket engine. First fill in what you know from the description of the kit and engine. Then mathematically manipulate the equation to solve for Δv.

m = _____

F = _____

Δt = _____

1. Determine what you don't know.

Δv = ?

Show all of your work in the space to the right of your known values.
Once you have calculated an answer, print it here:

Name _____ Date_____

Determining a Constraint Mathematically

2. Does that seem reasonable? Why or why not?

3. The answer you received is in units of meters per second. To figure out what the speed is in miles per hour you need to convert them by dividing the answer by 1609 meters/mile and multiplying that answer by 3600 seconds/hour.

What did you get for an answer?

4. Going back to the original project of designing a model rocket that went exactly 200 miles an hour at burnout: What one characteristic would you need to change?