Given m­sun = 1.989e30 kg, mearth = 5.972e24 kg, and using the perihelion initial conditions for velocity and distance where vearth = 30.3e3 m/s and rearth = 147.1e9 m/s our model percent errors at the aphelion can be seen below:

Expected distance: 152.10e9 m Simulated distance: 152.29e9 m Error: 0.12%

Expected velocity: 29.300e3 m/s Simulated velocity: 29.266e3 m/s Error: 0.11%

In addition, we validated our model by sweeping the initial velocities at the perihelion to find our simulate escape velocity. As can be seen below the result was very accurate.

Theoretical escape velocity = m/s

Simulated escape velocity = 42.4840e3 m/s Error: 0.00095%