If $m_S \to \frac{1}{2} m_S$ what happens?

When $m_s \to \frac{1}{2} m_s$ clearly $V \to \frac{1}{2} V$. However T, the kinetic energy does not change since

$$\Delta V = \int_{t-\varepsilon}^{t+\varepsilon} a \, dt = \int_{t-\varepsilon}^{t+\varepsilon} F/m \, dt$$

but F remains bounded so as $\varepsilon \to 0$ $\Delta V \to 0$.

So $T \to T$ and therefore the total energy $T + V \to T + \frac{1}{2} V$, i.e. with <u>a</u> for after, <u>b</u> for before

$$T_a + V_a = T_b + \frac{1}{2} V_b$$

But by the Virial Thm. $T_b = -\frac{1}{2} V_b$ so

$$T_a + V_a = 0$$

Hence after the mass change the earth's orbit has <u>zero</u> energy, i.e. <u>is</u> <u>a</u> <u>parabola</u>. So the earth goes off to ∞. What a fate!