The object shown is a sheet of material of density \( \rho \) bounded by the line \( y = 0, x = x_0 \) and the curve \( y = ax^3 \). The thickness perpendicular to the paper varies according to the relationship \( t = Cx \). \( C \), \( a \) and \( x_0 \) are constants. Calculate the \( x \) coordinate of the center of mass of this object. Express your answer in terms of numbers, \( x_0 \), \( c \) and \( a \) as needed.

**Solution:**

\[
x_c = \frac{\int x \, dm}{\int dm}, \quad \text{where}
\]

\[
dm = \rho \, ty \, dx = \rho ac \, x^4 \, dx
\]

\[
\int_0^{x_0} \rho ac \, x^4 \, dx = \int_0^{x_0} \rho ac \, x^5 \, dx = \frac{1}{6} x_0^6 = \frac{5}{6} x_0.
\]