389.

Problem 32.27 (RHK)

A wire with resistance of $6.0\,\Omega$ *is drawn out through a die so that its new length is three times its original length. Assuming that the resistivity and density of the material are not changed during the drawing process, we have to find the resistance of the longer wire.*

Solution:

Let A be the cross-sectional area of the original wire and let A' be its cross-sectional area after the wire has been stretched to three times its original length. As the mass of wire remains unchanged during the stretching process, the relation between A and A' is

$$Al\rho = A'(3l)\rho,$$

or

$$A' = \frac{A}{3}.$$

Resistance of a wire of length l, resistivity ρ_c and cross-sectional area A is $6.0\,\Omega$.

$$R = \frac{\rho_c l}{A}.$$

Therefore, the resistance of the stretched wire will be

$$R' = \frac{\rho_c (3l)}{A'} = \frac{\rho_c (3l)}{A/3} = 9\frac{\rho_c l}{A} = 9 \times 6\ \Omega = 54\ \Omega.$$