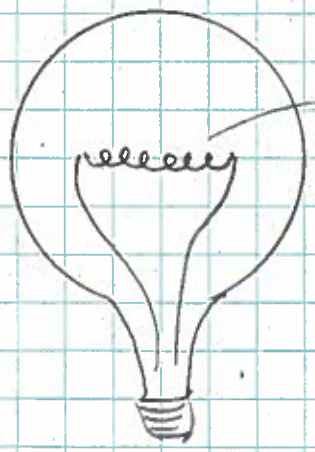

Bulb dissipates 100W when the potential across the filament is $\Delta V = 120V$

So:

$$P = 100W = I^2R = \frac{\Delta V^2}{R}$$

So: $R = \frac{\Delta V^2}{P} = 144\ \Omega$

Now:

$$R = \frac{\rho L}{A} = \frac{\rho L}{\pi r^2}$$

$\therefore$ $r = \sqrt{\frac{\rho L}{\pi R}} = 1.18 \times 10^{-5} m$ $\rho = 9 \times 10^{-7}\ \Omega \cdot m$ for Tungsten

$= 11.8\ \mu m$

$\therefore$ $\underline{d = 23.6\ \mu m}$