Question #57190: A steel rod is 2.5cm in diameter at 27C. A brass ring bar has an inner diameter of 2.498 cm at the same temp. At what common temp will the ring just slide onto the rod?

Given:

$d_{s1} = 2.5\ cm$

$t_{s1} = t_{b1} = 27℃$

$d_{b1} = 2.498\ cm$

$\theta = ?$

Solution:

$$d_{s2} = d_{b2}$$

$$d_{s1}\left(1 + \alpha_s(\theta - t_{s1})\right) = d_{b1}\left(1 + \alpha_b(\theta - t_{b1})\right)$$

From where we can find out:

$$\theta = \frac{d_{b1} - d_{s1} + t_{s1}(d_{s1}\alpha_{s1} - d_{b1}\alpha_b)}{d_{s1}\alpha_s - d_{b1}\alpha_b}$$

Taking into account that $t_{s1} = t_{b1}$

$$\theta = t_{s1} + \frac{d_{s1} - d_{b1}}{d_{b1}\alpha_b - d_{s1}\alpha_s} = 146.67\ ℃$$

Answer: $\theta = 146.67\ ℃$