Question#20151

a steel ball bearing is 4cm at 20c.a bronze plate has ahole in it that is 3.9cm in diameter at 20c.what common temperature must they have so the ball just spueezs through the hole ?.

Solution:

Let:

$D_1 = 4\ cm$

$D_2 = 3.9\ cm$

$t_0 = 20\ ^\circ C$

$t - ?$

$D_1{}^t = D_1 + D_1\alpha_{steel}(t_1 - t_0)$

$D_2{}^t = D_2 + D_2\alpha_{bronze}(t_1 - t_0)$

Were:

$\alpha_{steel} = 11 * 10^{-6}\ ^\circ C^{-1}$ Is the coefficient of thermal expansion of the steel.

$\alpha_{bronze} = 18 * 10^{-6}\ ^\circ C^{-1}$ Is the coefficient of thermal expansion of the bronze.

Such as:

$D_1{}^t = D_2{}^t$

$D_1 + D_1\alpha_{steel}(t - t_0) = D_2 + D_2\alpha_{bronze}(t - t_0)$

$$\boldsymbol{t = \frac{D_1(t_0\alpha_{steel} - 1) - D_2(t_0\alpha_{bronze} - 1)}{D_1\alpha_{steel} - D_2\alpha_{bronze}}}$$

$$\boldsymbol{t = \frac{4(20 * 11 * 10^{-6} - 1) - 3.9(20 * 18 * 10^{-6} - 1)}{4 * 11 * 10^{-6} - 3.9 * 18 * 10^{-6}} = 3837\ ^\circ C}$$

Answer: 3837 ^{0}C.