Question.

A containers volume is reduced by 75% And the gas inside had an initial temperature of 10 degrees Celsius. What is the final temperature in degrees Celsius if it compressed polytropically with n= 1.45

$V_2 = 0.25V_1$

$T_1 = 10°C = 283\ K$

$n = 1.45$

$T_2 = ?$

Solution.

The polytropic equation:

$$PV^n = const$$

But from the equation of ideal gas we know

$$PV = RT \rightarrow \frac{PV}{T} = R = const \rightarrow P = \frac{const}{V}T$$

Therefore,

$$TV^{n-1} = const$$

In our case,

$$T_1V_1^{n-1} = T_2V_2^{n-1} = const \rightarrow T_2 = T_1\left(\frac{V_1}{V_2}\right)^{n-1}$$

Calculate:

$$T_2 = 283 \cdot 4^{0.45} = 283 \cdot 1.866 = 528.1\ K = 255.1°C$$

Answer.

$T_2 = T_1\left(\frac{V_1}{V_2}\right)^{n-1} = 528.1\ K = 255.1°C$