Pressure-Temperature Adiabatic Relationship For Gases

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$$P.V^{\gamma} = Constant$$
$$P.V = n.R.T$$
$$V = \frac{n.R.T}{P}$$
$$P.\left(\frac{n.R.T}{P}\right)^{\gamma} = Constant$$
$$P^{1-\gamma}.T^{\gamma}.(n.R)^{\gamma} = Constant$$

n and R and gamma are also constants

$$P^{1-\gamma}.T^{\gamma} = Constant$$
$$P_1^{1-\gamma}.T_1^{\gamma} = P_2^{1-\gamma}.T_2^{\gamma}$$
$$T_2^{\gamma} = \left(\frac{P_1^{1-\gamma}}{P_2^{1-\gamma}}\right).T_1^{\gamma}$$
$$T_2^{\gamma} = \left(\frac{P_2^{\gamma-1}}{P_1^{\gamma-1}}\right).T_1^{\gamma}$$
$$(T_2^{\gamma})^{\frac{1}{\gamma}} = \left(\left(\frac{P_2^{\gamma-1}}{P_1^{\gamma-1}}\right).T_1^{\gamma}\right)^{\frac{1}{\gamma}}$$
$$T_2 = T_1.\left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}}$$

$\gamma =$ Specific heat ratio $\left(\frac{c_p}{c_v}\right)$. Dimensionless, 1.40 for Air, Standard (Engineering Toolbox).

Use absolute pressure and temperature.