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PressAlt

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ATMOSPHERIC PRESSURE THEORY
for
A GIVEN ALTITUDE

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ATMOSPHERIC PRESSURE CALCULATION

a) Constant Temperature Assumption

$$dp = -\rho g dh$$

$$dp = -\frac{p}{R.T} g dh$$

$$dp = -9.81 \frac{p}{287.T} dh$$

$$\frac{dp}{p} = -\frac{9.81}{287.T} dh$$

$$\frac{dp}{p} = -\frac{1}{T}(0.03418 x dh)$$

$$\int \frac{dp}{p} = \frac{0.03418}{T} \int dh$$

$$\ln p = -\frac{0.03418}{T} h + C \qquad h = 0 \Rightarrow p = P_0$$

$$\ln(p) - \ln(P_0) = -\frac{0.03418}{T} h$$

$$\ln\left(\frac{p}{1.013 x E^5}\right) = -\frac{0.03418}{T} h$$

$$\boxed{P = P_0 \times e^{\left(-\frac{0.03418}{T} \times H\right)}}$$

b) Linear Temperature Assumption

$$dp = -\rho g dh$$

$$dp = -\frac{p}{RT} g dh$$

$T = T_0 - \alpha.z$ $\left(\alpha = 0.0065\ K°/m\right)$ Lapse Rate for Atmospheric Pressure

$$\frac{dp}{p} = -\frac{9.81}{287.T} \int_0^H \frac{dh}{T_0 - \alpha z}$$

$$\boxed{P = P_{atm}\left(\frac{T_0 - \alpha_z}{T_0}\right)^{g/\alpha R}}$$

c)S imple Linear Aproximation

$$\boxed{P = P_o - \rho g h}$$

Resources:
Mechanics of Fluids, Merle C. POTTER, David C. WIGGERT, Midhat HONDZO
Fluid Mechanics, Frank M. WHITE