Air Density and Density Altitude - Demystified

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From Physics of an Ideal Gas

- P*V = n*Rg*T
- where: P = pressure
             V = volume
              n = number of moles
           Rg = universal gas constant
           T = temperature
- Density is mass per unit Volume, or
- D = m / V

Physics (cont.)

- Note that:
  - $m = n * M$

  - where: m = mass
    - n = number of moles
    - M = molar mass

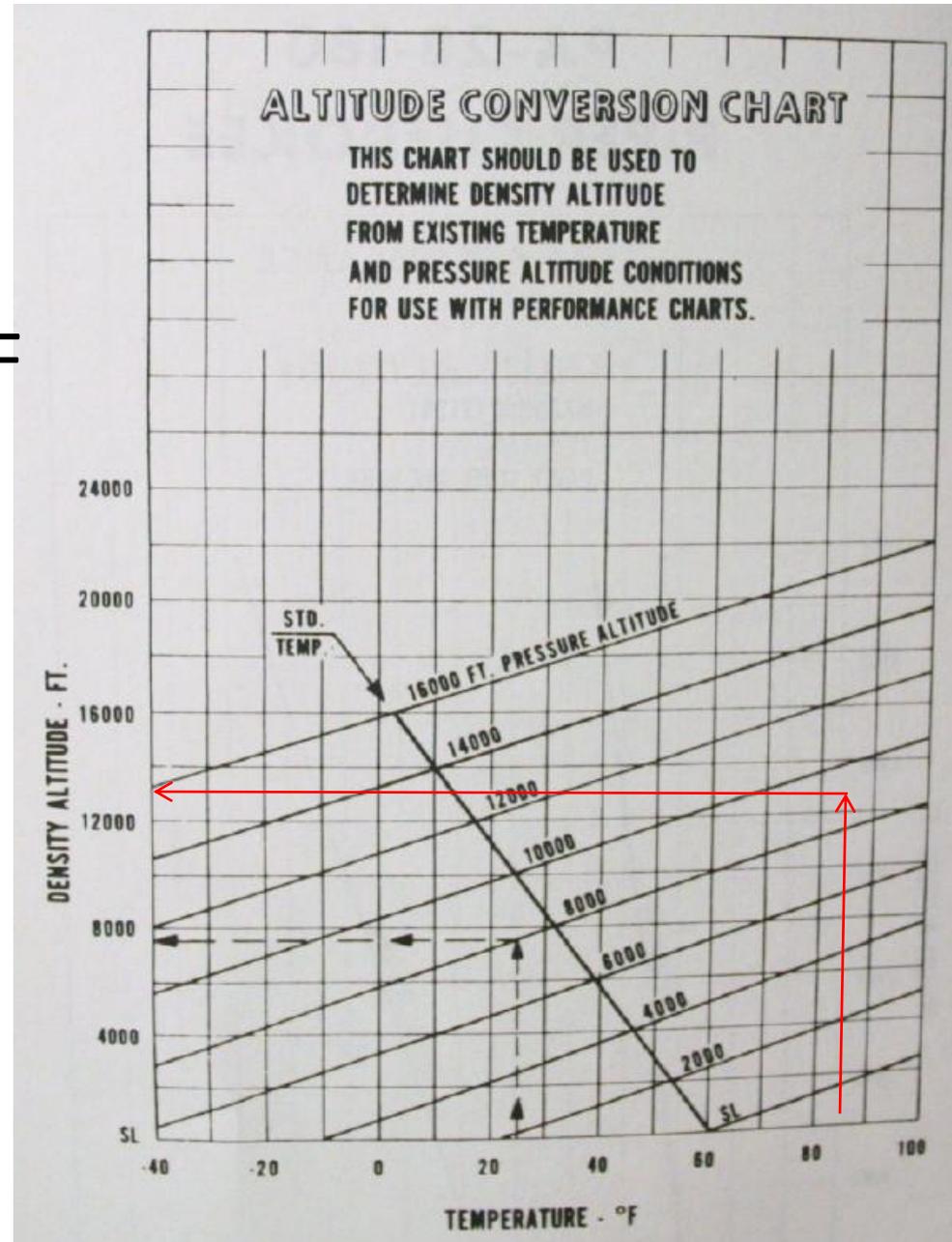- Solving for the Molecular formation of dry air ($R = Rg / M$)

$$D = \frac{P}{R * T}$$

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- Indicates Density Follows Pressure and is Inverse to Temperature

- Typically We Speak of Air Density as its Theoretical Altitude (Density Altitude)

- Think of it as its Altitude You Would Need to Either Go To In Order to Have That Air Pressure for That Air Density

- Normally it is Charted, or Obtained from an E6B

Density Altitude

- Recall Our Leadville Example, 9,934', T = 85F

- Chart Shows ~13,800'

- But What About Dew Point?

ALTITUDE CONVERSION CHART

THIS CHART SHOULD BE USED TO DETERMINE DENSITY ALTITUDE FROM EXISTING TEMPERATURE AND PRESSURE ALTITUDE CONDITIONS FOR USE WITH PERFORMANCE CHARTS.

Does Dew Point Effect Density Altitude?

- Density of Moist Air is Less than that of Dry Air; Hence, Density Altitude Increases

- As Temp - Dewpoint Spread Decreases, Effect is More Pronounced

- E.g., http://www.pilotfriend.com/calcs/calculators/density.htm

- If Dewpoint is 80 deg F, then Density Altitude = 14,286'

Density Altitude

- Major Impact on Aircraft Performance
- Landing Distance
- Takeoff Distance
- Rate of Climb