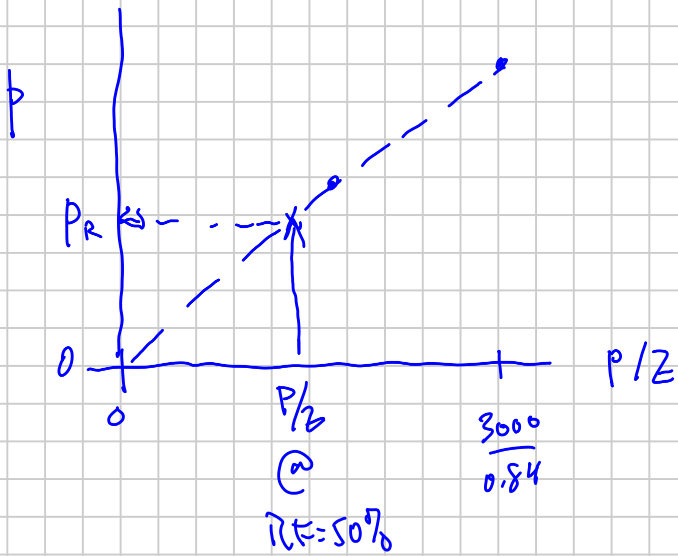
Note Title 5/18/2016

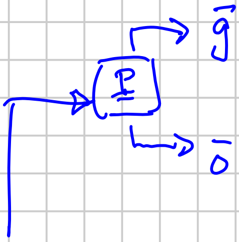


When should you use ideal gas law for an oil?

"Wet Gas" Volume $\equiv n \times \frac{R T_{sc}}{p_{sc}}$

379 scf/lb-mole

23.68 Sm^3/kg-mole

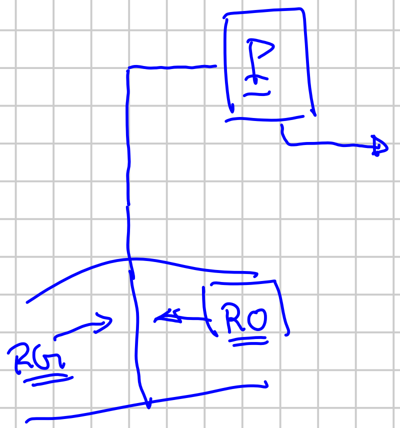


$n = n_{\bar{g}} + n_{\bar{o}} \cdot \frac{R T_{sc}}{p_{sc}}$

$$F_{\bar{o}o} = \frac{V_{\bar{o}o}}{(V_{\bar{o}o} + V_{\bar{o}g})} = \frac{V_{\bar{o}o}}{V_{\bar{o}}} = \frac{1 - r_s R_p}{1 - R_s r_s}, \quad \ldots\ldots\ldots\ldots\ldots \quad (7.6)$$

% of total surface oil coming from Ro

$\rightarrow V_{\bar{g}}$



$V_{\bar{o}} = V_{\bar{o}g} + V_{\bar{o}o}$

$= V_{\bar{o}o} +$

$R_p = \frac{V_{\bar{g}}}{V_{\bar{o}}}$

$r_s = \frac{V_{\bar{g}g}}{V_{\bar{o}g}}$

$R_s = \frac{V_{\bar{g}o}}{V_{\bar{o}o}}$

$V_{\bar{o}} = 1 \text{ STB} = V_{\bar{o}o} + V_{\bar{o}g}$

$V_{\bar{g}} = R_p \cdot 1 = V_{\bar{g}o} + V_{\bar{g}g}$

$R_s V_{\bar{o}o} + r_s V_{\bar{o}g}$

$V_{\bar{g}} = V_{\bar{g}g} + V_{\bar{g}o}$

$V_{\bar{g}g} = r_s V_{\bar{o}g}$

$V_{\bar{g}o} = R_s V_{\bar{o}o}$

ρ_g Real Gas Law [lbm/ft^3]

$= \frac{m_g}{V_g}$

$=$

$pV_g = n_g RT$

$M_g = \frac{m_g}{n_g} \Rightarrow n_g = \frac{m_g}{M_g}$

$m_g = n_g M_g$

$pV_g = \frac{m_g}{M_g} RT Z_g$

$$\boxed{\frac{p M_g}{R T Z_g}} = \frac{m_g}{V_g} = \rho_g$$

$\downarrow D$

$$\frac{dp}{dD} = -\rho g$$

$$\left[\frac{lbf}{ft}\right] \quad \frac{psi}{ft} = \frac{1}{144}\,\rho\left[\frac{lbm}{ft^3}\right]\left(\frac{g}{g_c}\right)$$

$$\frac{144\ in^2}{ft^2}$$

Field Units

$lb_m \leftrightarrow lb_f$

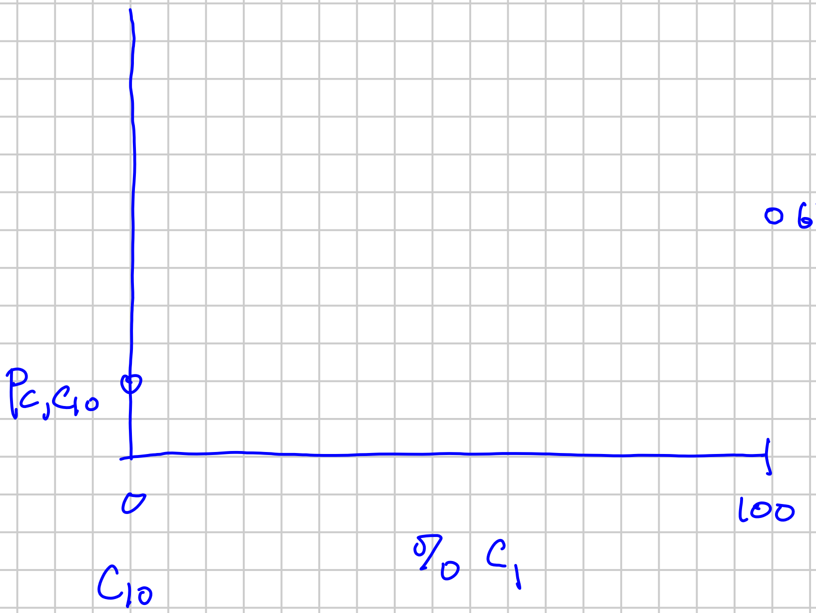
g_c

32. = "g"

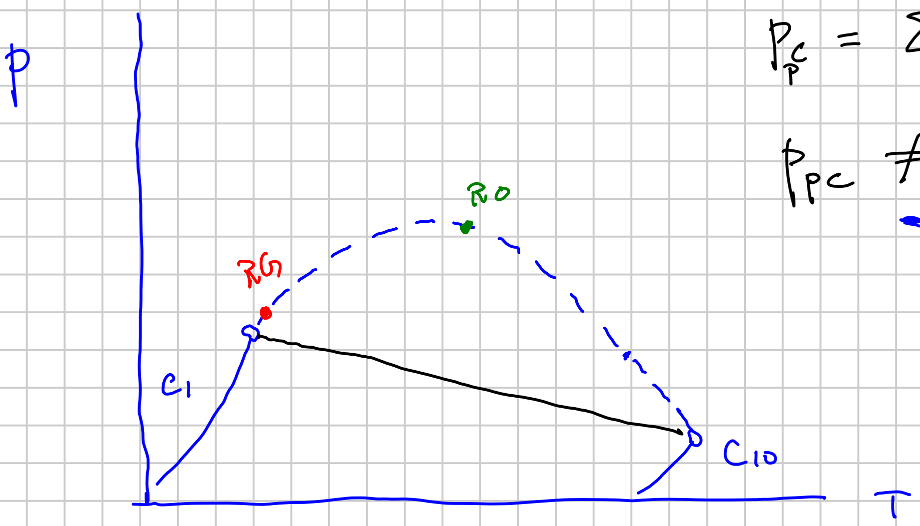
unit conversion from $lb_m \Leftrightarrow lb_f$

32. [ ]

2009



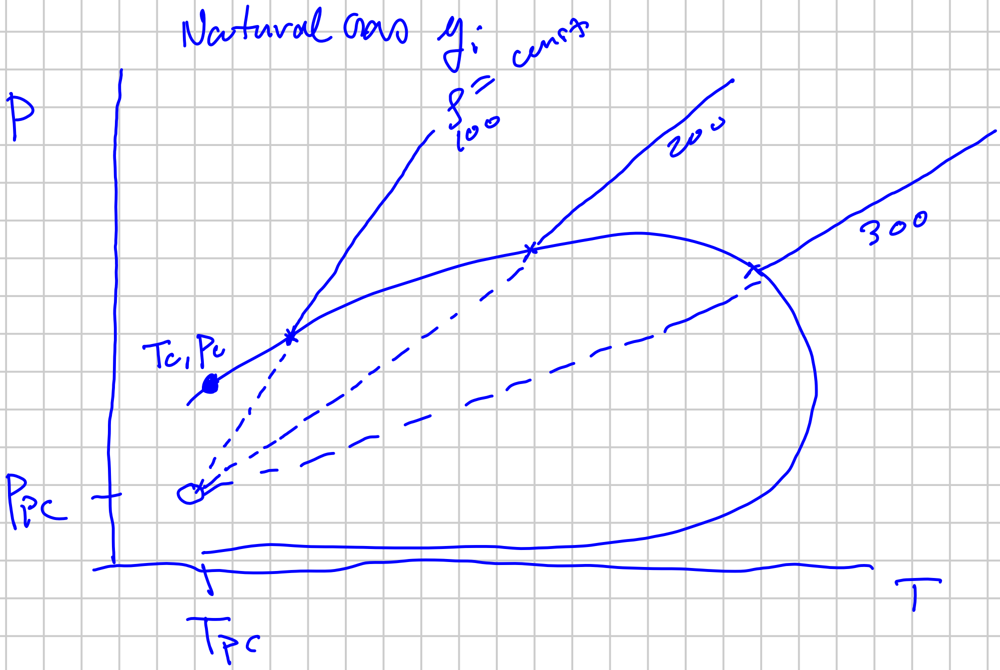
0 670psia P_{c,C_1}



$y_i \quad x_i$

$$P_{pc} = \sum y_i P_{ci}$$

$$P_{pc} \neq P_c \text{ mixture}$$



2009

(3a) Z ignored

$$q_g = \frac{0.703\, kh\,(P_R^2 - P_{wf}^2)}{(\mu Z)\, T_R \left[\ln \frac{r_e}{r_w} - \frac{3}{4} + s\right]}$$

$P_R \lessapprox 150$ bar $\qquad (\mu Z) \sim$ constant

3b

$$q_{\bar{o}} = q_{\bar{g}}\, r_s$$

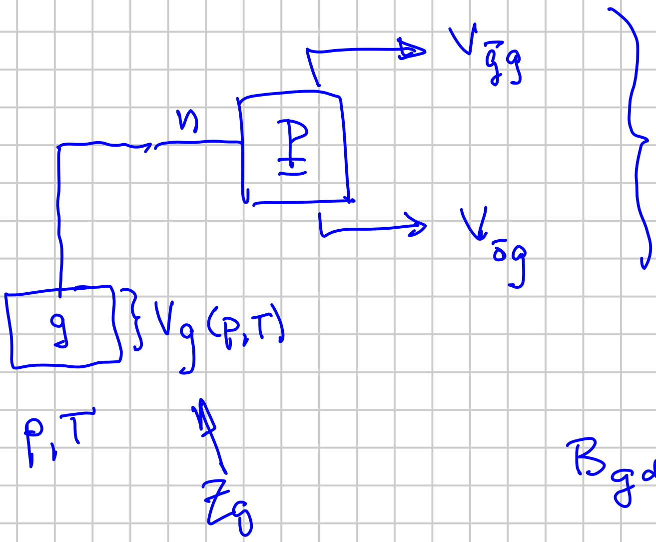
Surface Gas

$$B_g = \frac{P_{sc}}{T_{sc}} \cdot \frac{T_R Z}{P}$$

$\boxed{v_g \Rightarrow q_{gR}}$

$$\frac{q_{gR}}{B_g} = q_{\bar{g}} = \frac{kh\,(P_R^2 - P_{wf}^2)}{T_R\,(\mu Z)\,[\quad]}$$

(q_{gR} ← q_g)



Surface

Ficticous "Wet" Gas Volume

$$V_{\bar{g}w} = n \cdot \frac{R T_{sc}}{p_{sc}}$$

$(n_{\bar{g}g} + n_{\bar{o}g})$

Gas Phase

$$B_{gd} \equiv \frac{V_g(p,T)}{V_{\bar{g}g}}$$

$$B_{gw} \equiv \frac{V_g(p,T)}{V_{\bar{g}w}} = \frac{p_{sc}}{T_{sc}} \frac{T_R Z_g}{p}$$

<u>PVT Reports</u> $B_g = B_{gw}$

<u>Black-Oil PVT</u> B_{gd}

$B_{gd} > B_{gw}$