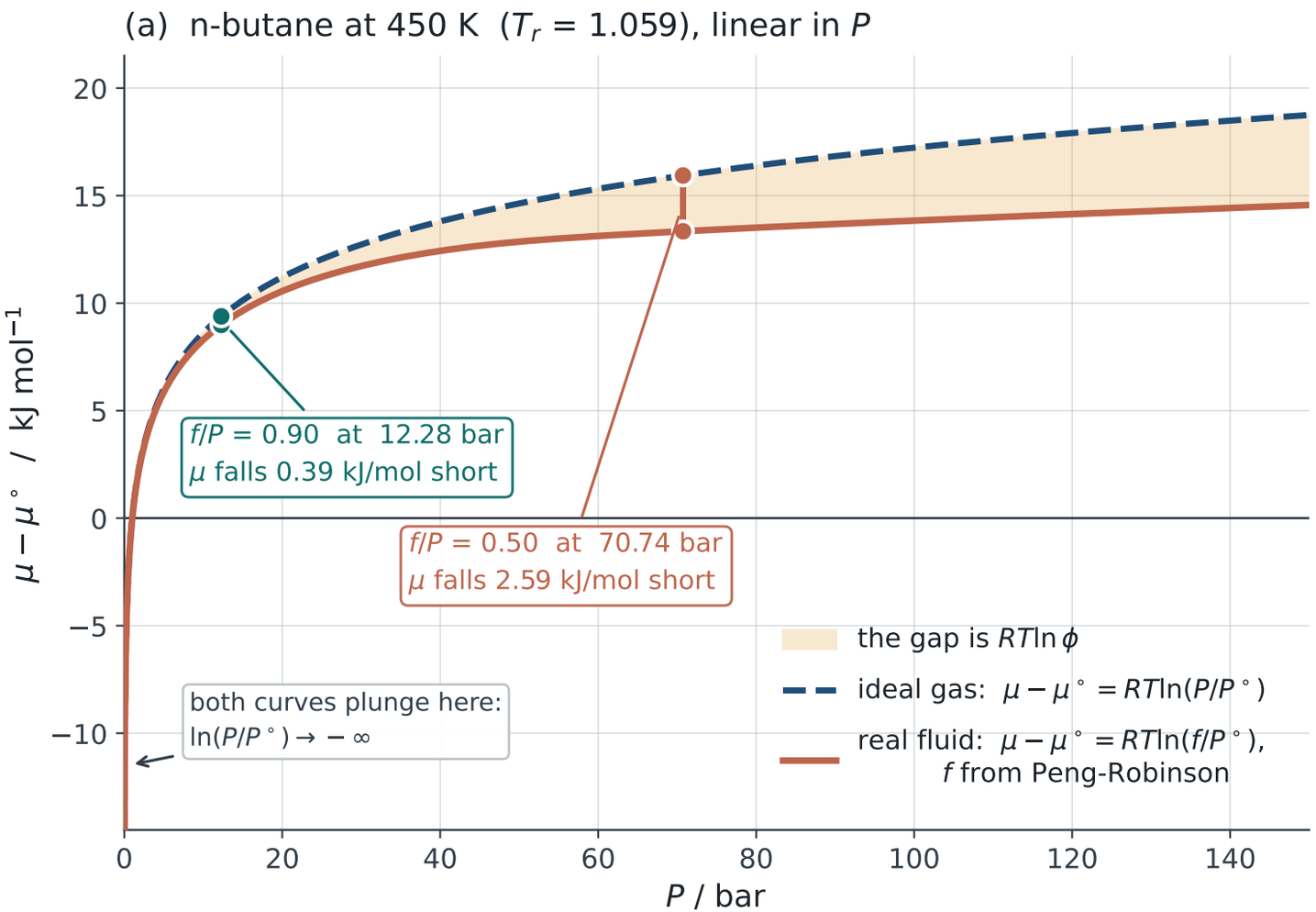
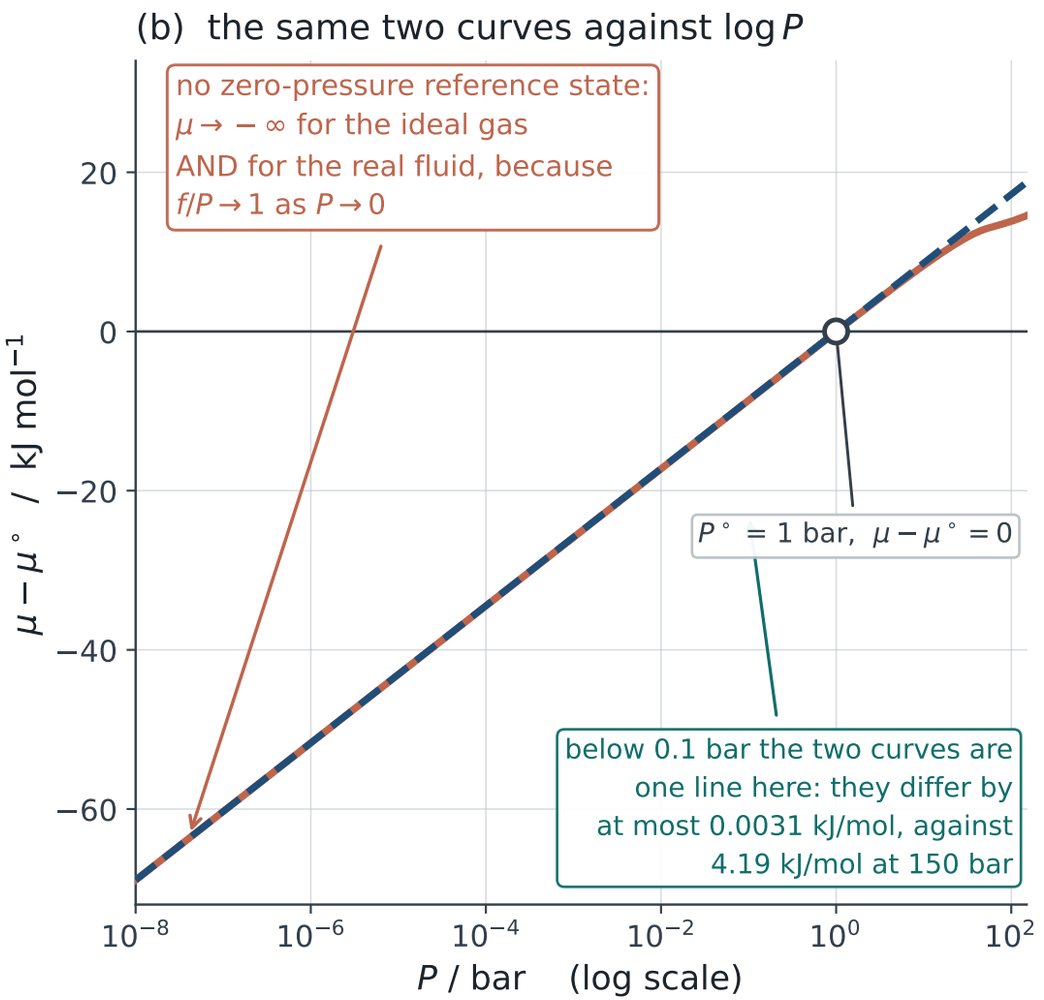
The logarithm is the whole difficulty: it separates the two curves at high P and it destroys both of them at $P = 0$





n-butane, T_c = 425.12 K, P_c = 37.96 bar, ω = 0.2 [Yaws, log10(mmHg), T in C; Tc/Pc/omega Poling et al.].

Fugacity from `vlekit.cubic.PengRobinson.phi`, 1976 α function, root chosen by lower G; at T_r = 1.059 there is only one root, so no phase choice arises.

ASSUMED (a definition, not a measurement): P° = 100 kPa and the standard state is the ideal gas at P°. RT = 3.7415 kJ/mol at 450 K.

At 150 bar, f/P = 0.3267, so μ falls 4.19 kJ/mol short of the ideal-gas value.