Quiz 1 (50 mins)

Quiz Rules

1. You are expected to abide by highest standards of academic honesty. You have been apprised of it during the first lecture.

2. State the assumptions made very clearly.

3. You are allowed to carry calculator and pen.

4. *Above all, read the question carefully.*

1. [100 points] CO and H_2 reacts to form CH_3OH in presence of a Cu catalyst. The feed stream entering the reactor has $H_2/CO = 2$ at 275 °C. The reactor is operated at 200 bar. Determine the effluent composition from the reactor, if the reactor operates isothermally and equilibrium is achieved.

   You are given the following data:

   (a) Equilibrium constant defined based on fugacities (or activities) is given by:
   $\log_{10} K_f = \frac{3835}{T} - 9.150 \log_{10} T + 3.08 \times 10^{-3} T + 13.20$

   (b)

	T_c (K)	P_c (bar)
H_2	33	35
CO	134	13
CH_3OH	513	82

   The fugacity coefficients in terms of reduced parameters are provided at the end. Assume the gas mixture to be ideal solution. Assume the standard state to be pure gas of unit fugacities (bar).
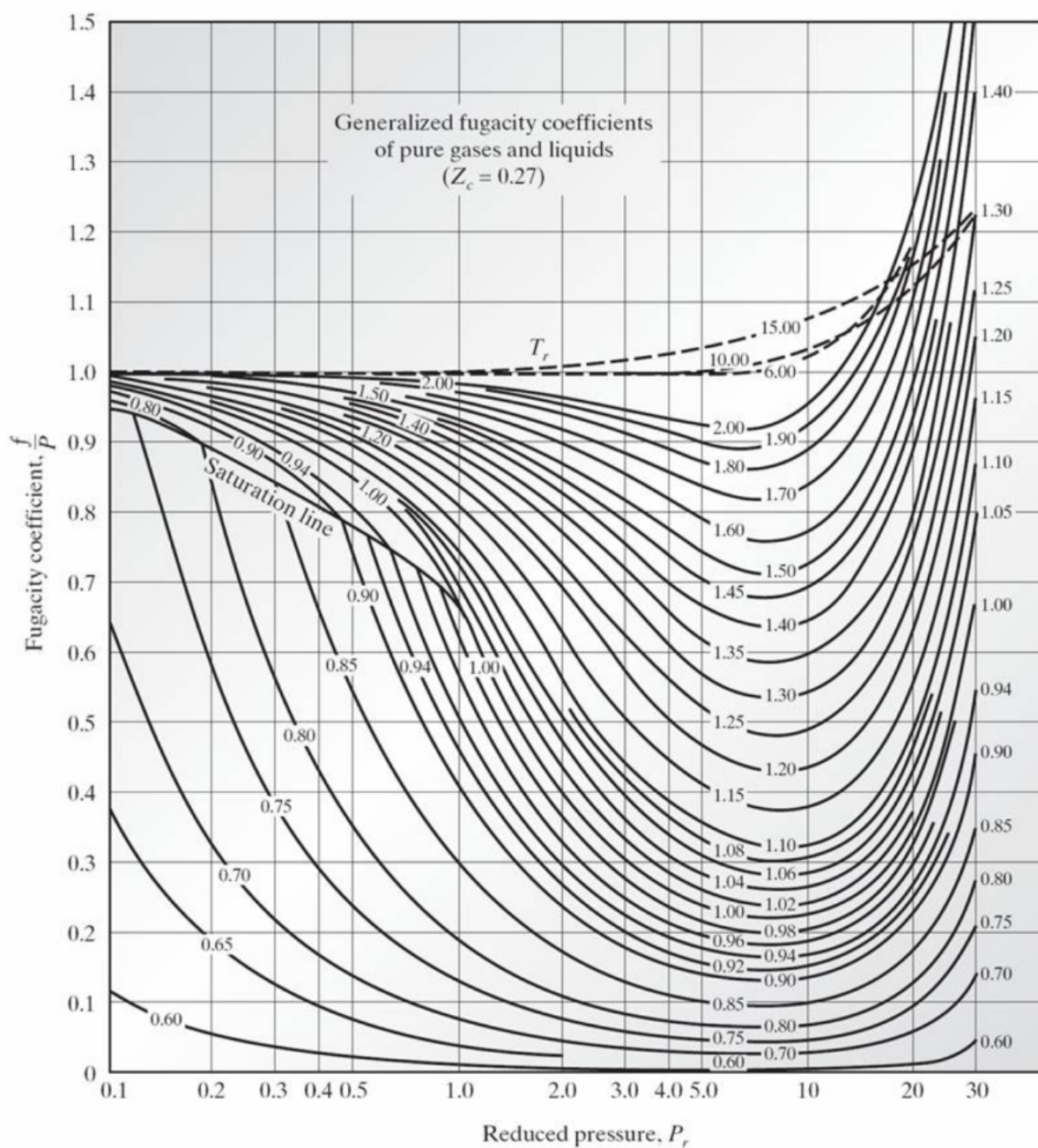
Figure 1: Fugacity coefficient (ϕ) as a function of reduced P_r and reduced temperature T_r. Taken from O. Hougen, K. M. Watson, and R. A. Ragatz, Chemical Process Principles charts, 2nd edition, Wiley, 1960.