CHG 1125
QUIZ 5

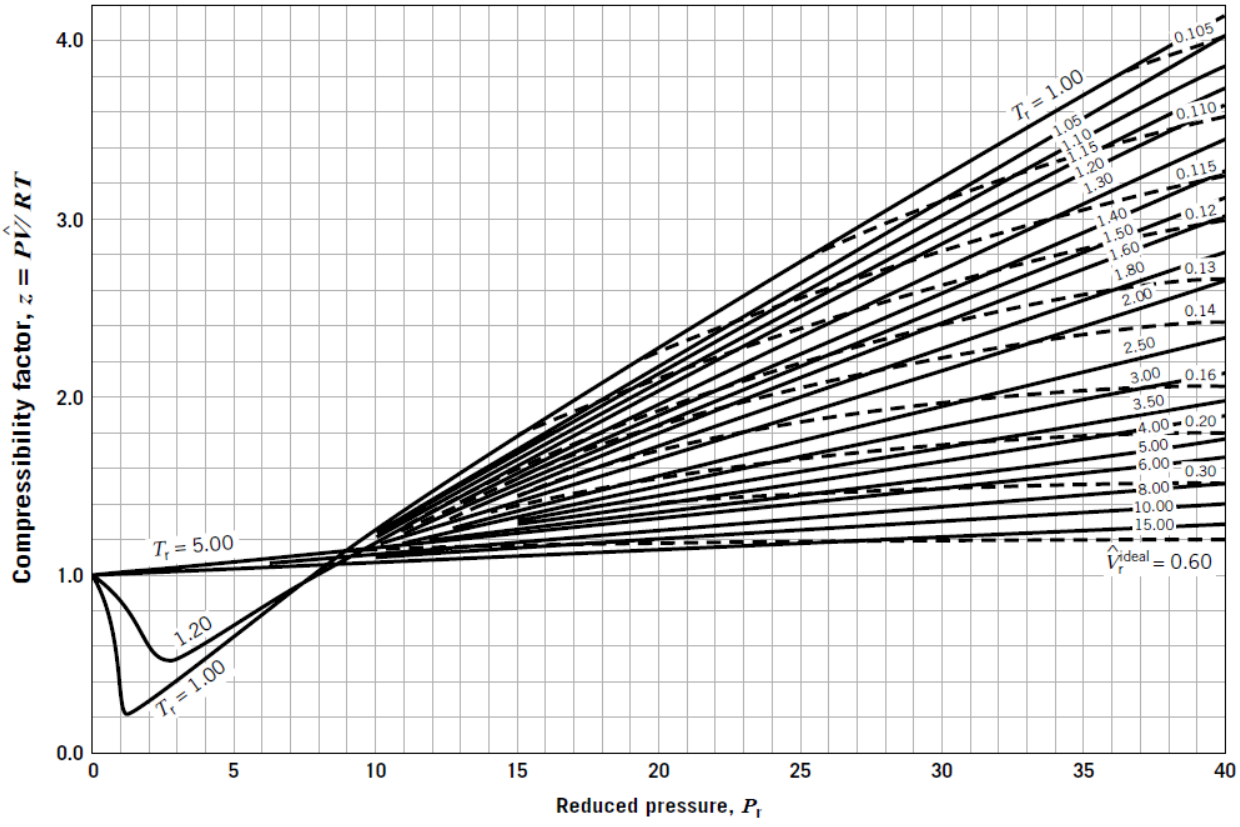
Last Name: _____
First Name: _____
Student Number: _____

Duration: 30 minutes

Given the following composition and properties of a 250 kmol gas mixture (P = 1500 atm, V = 22 m^3), determine the temperature of the **nonideal gas** mixture.

Component	y	T_c (K)	P_c (atm)
N_2	0.20	126.2	33.5
O_2	0.15	154.4	49.7
CO	0.20	133.0	34.5
CO_2	0.25	304.2	72.9
C_3H_6O	0.20	508.0	47.0

Compressibility Chart, High Pressures



Solution:

Given: P=1500 atm V = 22m^3, n = 250 kmol

C_3H_6O is identified as component x based on part a

Using Kay's law and knowing the gas contains N_2, O_2, CO, CO_2 and C_3H_6O (whose mole fractions are 0.2, 0.15, 0.2, 0.25, and 0.2 respectively)

P'c = (0.2*33.5 atm) + (0.15*49.7 atm) + (0.2*34.5 atm) + (0.25*72.9 atm) + (0.2*47 atm)

=48.68 atm

Pr = P/P'c = 1500atm / 48.68 atm = 30.8

T'c = (0.2*126.2 K) + (0.15*154.4K) + (0.2*133K) + (0.25*304.2K) + (0.2*508K)

= 252.65K

Vhat = V/n = 22 m^3/ 250 000mol = 0.000088 m^3/mol

Vr hat ideal = (P'c*Vhat)/(R*T'c) = (48.68 atm * 101325 pa/atm * 0.000088 m^3) / (8.314 m^3Pa/K-mol * 252.65 K)

=0.207

From high pressure compressibility chart with Pr = 30.8 and Vrhatideal = 0.207 z = 1.75

PV=znRT

T=PV/znR = (1500 atm * 101325 pa/atm * 22m^3) / (1.75*250000mol*8.314 m^3Pa/K-mol)

= 919.27 K