FALL 2000 (Final)

a) IGL

methane: $\frac{802\,kg \mid 1\,kmol}{16.041\,kg} = 50\,kmol$

CO_2: $\frac{1,100.25\,kg \mid 1\,kmol}{44.01\,kg} = 25\,kmol$

Ethane: $\frac{751.75\,kg \mid 1\,kmol}{30.07\,kg} = 25\,kmol$

Total = 100 kmol

$$V = \frac{nRT}{P} = \frac{(100\,kmol)\left(0.08205\,\frac{atm \cdot m^3}{kmol \cdot K}\right)(298.15\,K)}{7,250,000\,Pa\left(\frac{1\,atm}{101325\,Pa}\right)}$$

$$\boxed{V = 34.19\ m^3}$$

b) make table

	x_i	T_{ci}	$x_i T_{ci}$	P_{ci}	$x_i P_{ci}$	ω_i	$x_i \omega_i$
methane	0.5	190.6	95.3	45.4	22.7	0.008	0.004
CO_2	0.25	304.2	76.05	72.8	18.2	0.225	0.056
Ethane	0.25	305.4	76.35	48.2	12.1	0.098	0.025
total	1		247.7		53		0.085

$T_{pc} = 247.7\,K$

$P_{pc} = 53\,atm$

$\omega_{pc} = 0.085$

$T_r = \frac{298.15}{247.15} = 1.2$

$P_r = \frac{7,250,000\,Pa}{53\,atm\left(\frac{101325\,Pa}{1\,atm}\right)} = 1.34$

$z = 0.72$ $\quad V = \frac{(100\,kmol)(0.72)\left(0.08205\,\frac{atm \cdot m^3}{kmol \cdot K}\right)(298.15)}{7,250,000\,Pa\left(\frac{1\,atm}{101325\,Pa}\right)} = \boxed{24.6\,m^3}$

c) $z^{(0)} = 0.737 + \frac{1.34 - 1.2}{1.4 - 1.2}(0.690 - 0.737) = 0.7041$

$z^{(1)} = 0.1$

$z = 0.7041 + 0.085(0.12) = 0.714$

$V = \frac{(100)(0.714)(0.08205)(298.15)}{7,250,000\,Pa\left(\frac{1\,atm}{101325\,Pa}\right)} = \boxed{24.4\,m^3}$