King Saud University

Petroleum and Natural Gas Engineering

PGE 362: Properies of Reservior Fluids

Thursday, February 18, 2016

Tutorial Four

Q1

A 20-cu ft tank at 100°F is pressured to 200 psia with a pure paraffin gas. Ten pounds of ethane are added, and the specific gravity of the gas mixture is measured to be 1.68. Assume that the gases act as ideal gases. What was the gas originally in the tank?

Solution

V =	20
P =	200
T =	100
W.ethane =	10
Sp. Gr. =	1.68
n. paraffin =	0.6657
n. methane =	0.3333
n. T =	0.9990
Y. paraffin =	0.6663
Y. ethane =	0.3337
A.M.T =	48.72
M.wt. paraffin =	**58.09**

So the gas is Butane

Q2

A 2.4-cu ft cylinder of ethane shows a pressure of 1600 psig at 90°F. What is the mass in pounds of the ethane contained in the cylinder? Do not assume ethane is an ideal gas.

Solution

P =	1600	psig
T =	90	° F
V =	2.4	ft^3
Tc	89.92	° F
Pc	706.5	psia
Tr =	1.00	
Pr =	2.29	
Z =	0.32	
n =	2.05	
wt. =	61.56	lbm

Q3

A cylinder with an initial pressure of 14.7 psia and volume of 75,000 cc is held at a constant temperature of 200°F. The volume of the cylinder is reduced by insertion of mercury. The corresponding volumes (cc) and pressures (psia) of the gas inside the cylinder are recorded as follows.

Pressure:	400,	800,	1200,	2000,	2500,	3000,
	4000,	5000				
Volume:	2,448,	1,080,	648.6,	350.6,	295.9,	266.4,
	234.6,	206.2				

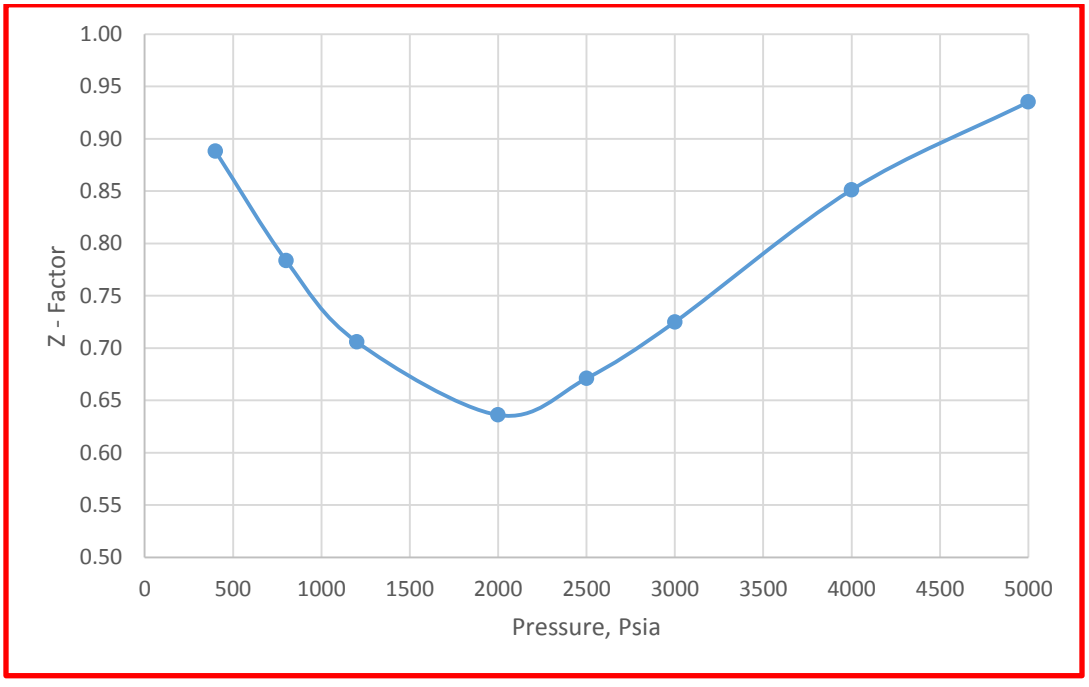
Calculate the ideal volumes for the gas at each pressure and use them to calculate the z-factors. Plot the z-factors against pressure.

Solution

P =	14.7	psia
V =	75000	CC
T =	200	°F

V =	2.6486	ft^3
T =	200	°R
n =	0.005498	moles

Pressure	Volume (CC)	Volume (ft^3)	Ideal Vol. (ft^3)	Ideal Vol. (CC)	Z
400	2448	0.086450	0.097336	2756.25	0.8882
800	1080	0.038140	0.048668	1378.13	0.7837
1200	648.6	0.022905	0.032445	918.75	0.7060
2000	350.6	0.012381	0.019467	551.25	0.6360
2500	295.9	0.010450	0.015574	441.00	0.6710
3000	266.4	0.009408	0.012978	367.50	0.7249
4000	234.6	0.008285	0.009734	275.63	0.8512
5000	206.2	0.007282	0.007787	220.50	0.9351



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Q4

A tank contains methane at 1000 psia and 140°F. Another tank of equal volume contains ethane at 500 psia and 140°F. The two tanks are connected, the gases are allowed to mix, and the temperature is restored to 140°F. Calculate the final pressure, the composition of the mixture, and the partial pressures of the components at final conditions. Do not assume that ideal gas equations apply.

Solution

V =	1	**assumed**
P1 =	1000	psia
T1 =	140	° F
Pc_1 =	667.8	
Tc_1 =	-116.68	343.32 °R
Pr_1 =	1.497454	
Tr_1 =	1.747641	
Z_1 =	0.92	
n_1 =	0.168835	moles
P2 =	500	psia
T2 =	140	° F
Tf =	140	° F
Pc_2 =	707.8	
Tc_2 =	90.1	550.1
Pr_2 =	0.706414	
Tr_2 =	1.090711	
Z2 =	0.78	
n2 =	0.099569	moles
n.t. =	0.268404	
PT/ZT	863.9911	

Final pressure =	**750**	psia
Composition		
$y_{methane}$ =	**0.6290**	
y_{ethane} =	**0.3710**	
$P_{methane}$ =	**471.8**	psia
P_{ethane} =	**278.2**	psia