

King Saud University

Petroleum and Natural Gas Engineering

PGE 362: Properties of Reservoir Fluids

Sunday, October 30, 2016

Tutorial Five

Q1

A container was found to weigh 80.00 g while evacuated. The container then was filled with oxygen and found to weigh 81.242 g. When filled with water the container weighed 1000.00 g. The temperature and pressure for the procedure were 14.7 psia and 60°F. What is the gas constant in engineering units?

Solution

Wc =	80	gm
Wc + Wo2 =	81.242	gm
Wc + WH2O =	1000	gm
P =	14.7	psia
P =	1	atm
T =	60	° F
T =	288.5556	° K
WO2 =	1.242	gm
WH2O =	920	gm
VO2 =	920	cm ³
nO2 =	0.038813	gm-mole
R =	82.14607	cm ³ atm K ⁻¹ mol ⁻¹

Q2

Determine the composition in mole fraction of the following gas.

Component	Composition, weight fraction
Methane	0.880
Ethane	0.043
Propane	0.042
n-Butane	0.035
	1.000

Solution

Component	Composition, weight fraction	M. wt.	wt	wi / M. wt	Yi
Methane	0.88	16	88	5.5000	0.9484
Ethane	0.043	30	4.3	0.1433	0.0247
Propane	0.042	44	4.2	0.0955	0.0165
n-Butane	0.035	58	3.5	0.0603	0.0104
	1		100	5.7991	1

Q3

What is the specific gravity of the following gas?

Component	Partial pressure, psia
Methane	17.8
Ethane	1.0
Propane	0.4
i- Butane	0.2
n-Butane	0.6
	20.0

Solution

Component	Partial pressure, Psia	Yi	M. wt.	Yi x M. wt.
Methane	17.8	0.89	16	14.24
Ethane	1	0.05	30	1.5
Propane	0.4	0.02	44	0.88
i-Butane	0.2	0.01	58	0.58
n-Butane	0.6	0.03	58	1.74
	20	1		18.94

Gas gravity = $18.94/29 = 0.6531$

Q4

Determine the value of z-factor for the gas given below at 5420 psig and 257°F.

Component	Composition, mole fraction
Hydrogen sulfide	0.100
Carbon dioxide	0.050
Nitrogen	0.021
Methane	0.703
Ethane	0.062
Propane	0.037
n-Butane	0.027
	1.000

Component	Composition, mole fraction	T _{ci}	P _{ci}	Y _i x T _{ci}	Y _i x P _{ci}
Hydrogen Sulfide	0.100	672.400	1300.000	67.240	130.000
Carbon Dioxide	0.050	547.900	1710.000	27.395	85.500
Nitrogen	0.021	227.500	493.100	4.778	10.355
Methane	0.703	343.400	666.400	241.410	468.479
Ethane	0.062	549.900	706.500	34.094	43.803
Propane	0.037	666.100	616.000	24.646	22.792
n-Butane	0.027	765.600	550.600	20.671	14.866
	1.000			420.233	775.796

$$\varepsilon = 120 \times (A^{0.9} - A^{1.6}) + 15 \times (B^{0.5} - B^4)$$

$$T_{pc}' = T_{pc} - \varepsilon$$

$$P_{pc}' = \frac{P_{pc} T_{pc}'}{T_{pc} + B(1-B)\varepsilon}$$

A =	0.150	
B =	0.100	
ξ =	20.73544	° R
T _{pc} =	420.233	° R
P _{pc} =	775.796	psia
T _{pc} ' =	399.498	° R
P _{pc} ' =	734.255	psia
P _{pr} =	7.401652	
T _{pr} =	1.794753	
Z =	1.06	