Reservoarfluider og Strømning
Reservoir Fluids and Flow
Course TPG 4145

Homework Problem 1

Handed Out: Jan. 19, 2016
Due Date: One week after handed out
Hand in on ItsLearning as a single Excel file; one sheet for 1.1 and another sheet for 1.2.
File Naming (mandatory!!!): LastName-Problem-1-Solution.xls

Problem 1.1 – **Reservoir Classification – *Gas or Oil?***
This problem refers to an example given in class Jan. 14, 2016.

Consider the reservoir Fig. 1 below. Due to geological events, the original reservoir (upper sketch) is faulted into three "fault blocks": H (high), M (middle) and L (low). The reservoir temperature and pressure increase with depth.

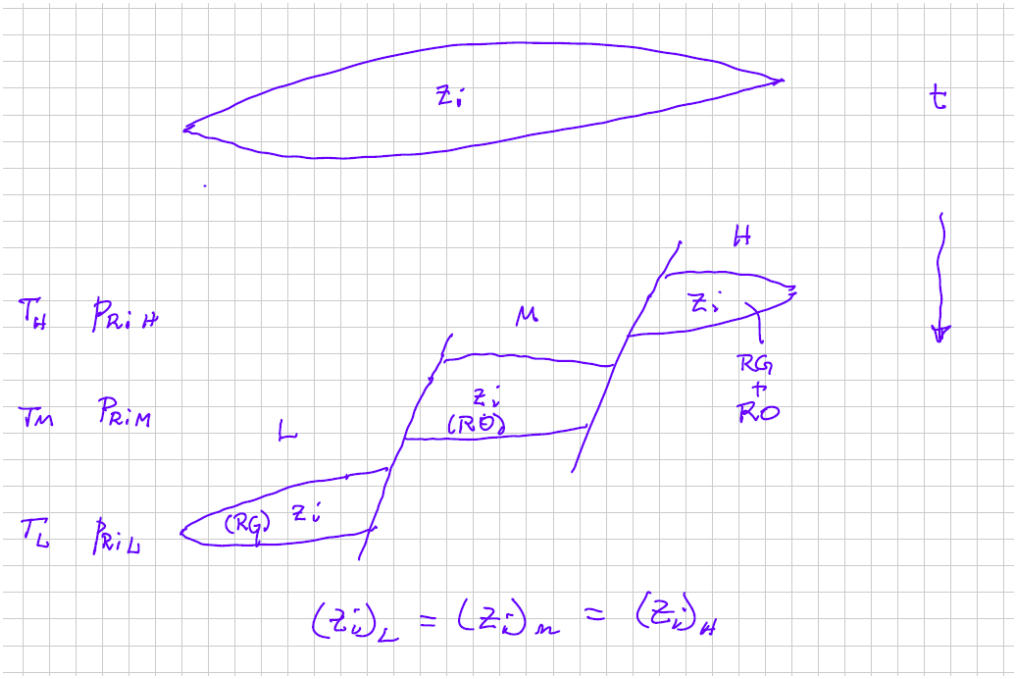

Fig. 1 – Sketch of reservoir, originally (above) and after faulting (below).

The total reservoir hydrocarbon fluid composition is the same in all blocks, z_i. However, one of the blocks is labeled an oil reservoir (RO), another a gas reservoir (RG), and the third one contains both oil and gas at reservoir conditions (RG+RO). To answer the following questions, use the p-T diagram given in Fig. 2.12 in the Phase Behavior Monograph.

Assume reservoir pressure of the middle fault block is 160°F and 2650 psia at mid-reservoir depth of 5300 ft, temperature gradient is 0.02°F/ft and pressure gradient is 0.5 psi/ft.

a. Come up with initial conditions (p_R, T_R) for High and Low reservoir fault blocks.
b. For the two-phase reservoir, give the approximate value for the volumetric percentage of the reservoir containing oil, $V_{RO}/(V_{RG}+ V_{RO})$.

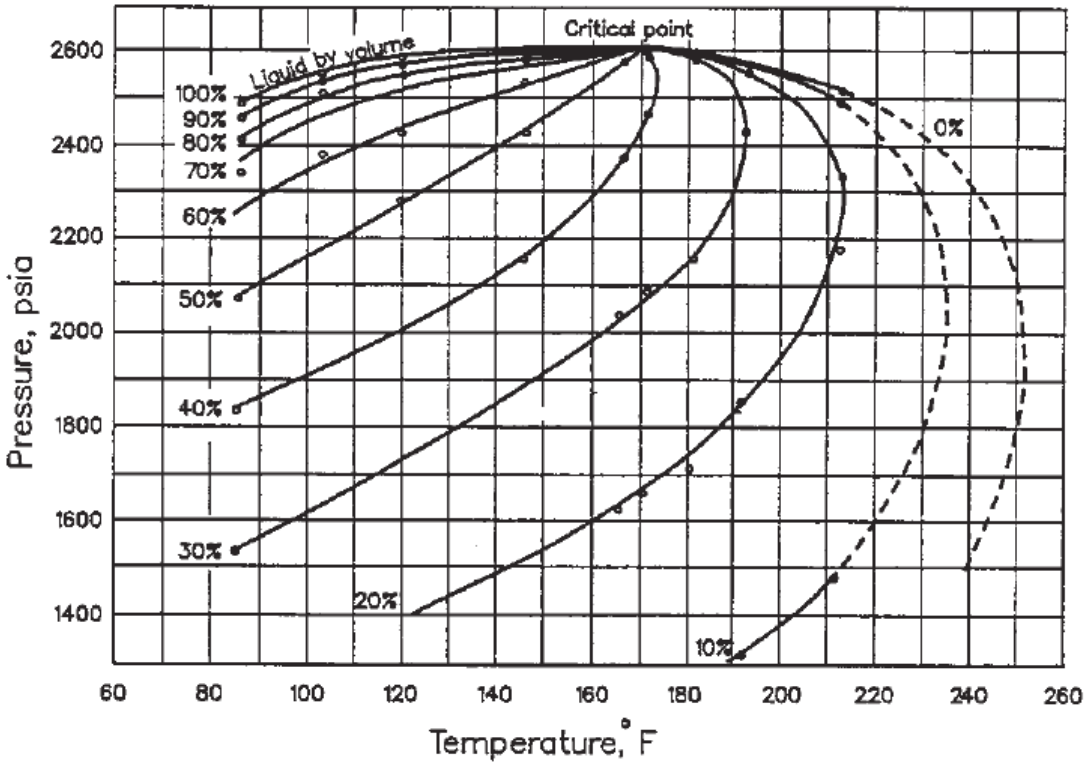

Fig. 2.12—*p-T* diagram for a gas-condensate system (after Katz *et al.*[5]).

Problem 1.2 – **Reservoir Fluid Composition**

This problem refers to Table 6.4 in the Phase Behavior Monograph. Solve the following questions using Excel.

a. Compute the average molecular weight of the fluid using data given in Table 6.4.
b. Calculate mole fractions (in mol-%) of each component from lab-measured mass (wt-%) fractions. Verify your results according to Table 6.4. Use Table A-1A (Appendix A) for component properties through n-C_5. Use Table 5.2 for C_6, and Table 6.4 for C_{7+}.
c. Lab measurement of C_{7+} molecular weight is often prone to uncertainty. Assume an uncertainty of 10%, using M_{C7+}=196 kg/kg-mole instead of the Table 6.4 reported value, then repeat steps (a) and (b).

TABLE 6.4—WELLSTREAM (RESERVOIR-FLUID) COMPOSITION FOR GOOD OIL CO. WELL 4 BOTTOMHOLE OIL SAMPLE

Component	mol%	wt%	Density* (g/cm^3)	°API*	Molecular Weight
H_2S	Nil	Nil			
CO_2	0.91	0.43			
N_2	0.16	0.05			
Methane	36.47	6.24			
Ethane	9.67	3.10			
Propane	6.95	3.27			
i-butane	1.44	0.89			
n-butane	3.93	2.44			
i-pentane	1.44	1.11			
n-pentane	1.41	1.09			
Hexanes	4.33	3.97			
Heptanes plus	33.29	77.41	0.8515	34.5	218
Total	100.00	100.00			

*At 60°F.