PET-342E Reservoir Engineering-I
Ö.İ.Türeyen
Homework#2
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İTÜ

Given: 3 April 2008
Due : 21 April 2008

Problem-1 (points:20)

While drilling an anticline structure, at a depth of 4,500 ft, (just above the productive formation), the pressure in a subsurface aquifer was measured as 1,998.6 psia. At a depth of 4,800 ft, oil contact was established. The pressure in the oil phase was measured to be 2,219.9 psia. The well was drilled through the oil column and another measurement of pressure in a subsurface aquifer was taken. At a depth of 5,500 ft, the pressure in the water phase was observed to be 2,438.6 psia. Using this information, calculate the depth of oil water contact.

If we had not measured the pressure in water, and instead would have relied on standard equation to estimate the pressure in the water phase, how much difference would have occured in our estimate of oil water contact? Assume the density of oil to be 45 lbm/ft 3

Problem-2 (points:20)

A wildcat is drilled into an oil reservoir. It encounters a Gas-Oil contact at 4,500 ft; the pressure at the Gas-Oil contact is 2,133 psia. Several samples of water collected from surrounding aquifers indicated an average water density of 64 lbm/cu.ft. A pressure measurement in a nearby aquifer at a depth of 4,300 ft was 2,033 psia. Hydrocarbon samples from the reservoir were analyzed; oil density was determined to be 48 lbm/cu.ft, while gas density was estimated at 8 lbm/cu.ft.

Answer the following questions:

(a) What is the water pressure equation? Is the reservoir normally or abnormally pressured? Why?

(b) Estimate the depth to the Oil-Water contact.

(c) If the well had been drilled into the gas cap at 4,350 ft (i.e., no Gas-Oil contact was encountered), approximately what value would you expect for the gas density of a sample collected at 4,350 ft? Explain your answer.

Problem-3 (points:20)

A well drilled into the top of a potential hydrocarbon reservoir encounters dry gas only at a depth of 5,800 ft. (See diagram). The reservoir thickness at this depth was 50 ft, and the reservoir temperature, 187 ±F.
Water pressure measurements were made in an adjecent aquifer at 6,300 ft (pressure=2839.2 psia) and at 6,500 ft, (pressure =2929.2 psia).

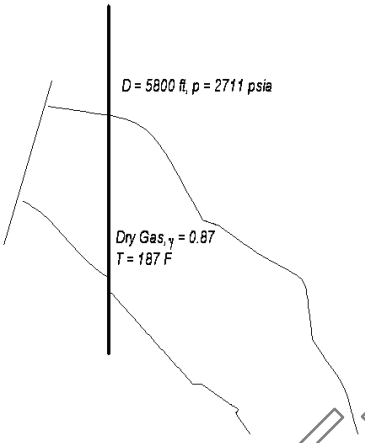
(a) If the reservoir contained dry gas only, calculate the depth to the reservoir gas-water contact.

(b) In nearby reservoirs, oil with specific gravity of 0.83 was found with the gas. Suppose oil with similar properties also existed in this reservoir. Estimate the deepest possible depth to the hydrocarbon-water contact in the reservoir.

(c) if oil existed in the reservoir, is it a wise strategy to produce from the gas cap? Explain your answer.

Problem-4 (points:20)

A well is drilled into a new gas reservoir. It encounters dry gas with specifc gravity of γ_g =0.66 at a depth of 5,620 ft; the pressure measured at this depth was 2,950 psia, and the temperature was 150 ±F. Pressure data were collected from nearby aquifers as follows: *pw*@ 5,650 ft=2805 psia; *pw*@ 5,700 ft=2830 psia. From this data, calculate the depth to the Gas-Water contact.



Problem-5 (points:20)

A reservoir contains gas with a specific gravity of 0.80, at a temperature of 149 0F. The following lists the reservoir's production history. (There was no water production)

Gp, MMMscf	*p*, psia
0	2538
10	2381
20	2223
30	2085
40	1940
50	1801

(All formulas for computing critical properties, etc. are provided on the attached formula sheet.) **Clearly state any assumptions you make in answering the following questions**.

i. Calculate initial gas in place.

ii. Assuming volumetric depletion, calculate the available reserves at an abandonment pressure of 450 psia.

iii. Suppose at an abandonment pressure of 450 psia, 10 MMbbl of water (*Bw* = 1) had encroached into the reservoir; how would your answer to part (ii) have changed? For this you can use the initial gas in place you have found in part-i.

The correlations for pc and Tc are given below:

$$P_c = -3.6\gamma^2 - 131\gamma + 756.8$$

$$T_c = -74\gamma^2 + 349.5\gamma + 169.2$$