

Transient Pressure Analysis
Spring Semester 2013-2014 / Final Exam
 (time : 3 hours)

Date : Sun.15/06/ 2014

Problem 1

(20 marks)

An oil well was producing oil, gas and water from a saturated reservoir as follows ; 1100 STB/d , 1800 m scf/d and 4200 STB/d respectively from a circular drainage area of 23 acres. The well was producing for 20.5 hours prior to shut-in for build-up test. The reservoir rock and fluid properties are :

Rs = 537 scf/STB	μ _o = 0.49 cp	μ _g = 0.01778 cp
μ _w = 0.231 cp	β _o = 1.34 bbl/STB	β _g = 1.424 bbl/m scf
β _w = 1.057 bbl/STB	C _o = 2.04 × 10 ⁻⁴ psi ⁻¹	C _g = 5.33 × 10 ⁻⁴ psi ⁻¹
C _w = 9.79 × 10 ⁻⁶ psi ⁻¹	C _f = 3.09 × 10 ⁻⁶ psi ⁻¹	S _w = 0.57
S _g = 0.1	φ = 0.165	h = 114 ft
r _w = 0.411 ft	γ _g = 0.80	T = 250° F

The pressure test data are:

<u>Δt, hrs</u>	<u>P_{ws}, psia</u>
0.0	
0.2	1750
0.3	1800
0.5	1875
0.75	1900
1.0	1912
2.0	1945
3.0	1963
5.0	1985
7.0	2000
10.0	2015
12.0	2020

Determine the following by using Horner method:

- 1). The total mobility .
- 2). Effective permeabilities; K_o , K_w and K_g.
- 3). Additional drop due to damage.
- 4). Average drainage area pressure.
- 5). Radius of investigation at shut-in time of 7 hours.

Problem 2

(20 marks)

A two- rate flow test was run by stabilizing the flow rate at 500 STB/day for 184.7 hrs then reducing the flow rate to 250 STB/day. The pressure data during the second rate are shown in the table below. Other pertinent data are :

μ _o = 0.805 cp	h = 69 ft	C _i = 10 × 10 ⁻⁵ psi ⁻¹
r _w = 0.198 ft	β _o = 1.137 bbl/STB	φ = 0.039
ρ _i = 4412 psia	ρ _o = 52.7 lb/ft ³	A _a = 0.0218 ft ²

The bottom-hole flowing pressure at time of rate change was 3490 psia:

Time, Δt	P_{wf}
<u>hrs</u>	<u>psig</u>
0.45	3654
0.93	3750
1.34	3795
1.94	3830
2.79	3853
5.78	3870
12.00	3890
17.30	3900

Determine :

- 1). The formation permeability .
- 2). The skin factor.
- 3). The pressure drops across the skin at rates q_1 and q_2 respectively.
- 4). The time needed to end the wellbore storage effect.

Problem 3

(20 marks)

1). A 3145 feet deep pumping well has a 2 inch outside diameter inside a 7.675 inch inside diameter casing, is preparing for a drawdown test , The average oil density in the wellbore is 45 lb/ft³. If this well produces from a reservoir with the following parameters :

$$\begin{array}{lll}
 k = 30 \text{ md} & h = 20 \text{ ft} & \Phi = 0.20 \\
 r_w = 0.333 \text{ ft} & \mu_o = 2.0 \text{ cp} & s = 5 \\
 C_o = 10 \times 10^{-6} \text{ psi}^{-1} & &
 \end{array}$$

Calculate : 1). The wellbore storage coefficient C.

2). The time required for wellbore storage effects to disappear.

2). If the well in problem 1 is build- up tested again after 6 months from that test, the average pressure was estimated in the second test to be 1800 psi , and the average oil production rate between the two tests was 950 STB/day. Estimate the external reservoir radius. Use the same fluid and rock properties as mentioned in problem 1.

Good Luck