Carbon Energy
(탄소에너지) (38523)

- 2024 Final Examination -

Student ID (학번):   **Student Name (성명):**

Notice

- Fill your name in the following:

  "I, _____, swear I solve all problems by myself in this final examination.

  I will take any disadvantages if any dishonesty such as cheating is acted on my solution."

  5 points will be deducted from your total score if you do not fill in your name above.

Problem 1.

Give the full name of each acronym below [1 pt./each]:

1-1.   API [1 pt.]

1-2.   EUR [1 pt.]

1-3.   EOR [1 pt.]

1-4.   GOC [1 pt.]

1-5.   OWC [1 pt.]

1-6.   NPV [1 pt.]

1-7.   PSC [1 pt.]

1-8.   OIIP [1 pt.]

1-9.   RF [1 pt.]

1-10. BOP [1 pt.]

Problem 2.

Describe characteristics of the petroleum industry (i.e., oil and gas industry) with technical terms. You **MUST** give a number to each term. You will be given 0.5 point for each term, if appropriate. Therefore, 10 is the maximum point you can earn from this problem. [10 pts.].

Example) A ① well is composed of ② casings and ③ tubing. …

Problem 3.

Describe a petroleum system with seven essential components. [10 pts.]

Problem 4.

4-1. Calculate the volumetric oil flow rate Q (bbl/day) if the reservoir extent area A = 60 acres [5 pts.].

4-2. Calculate the volumetric oil flow rate Q (bbl/day) if the reservoir extent area A = 120 acres [5 pts.].

Reservoir thickness h = 10 ft
Reservoir permeability k = 150 md
Well radius = 5.5 in
Bottomhole pressure at a production well = 1,000 psia
Current reservoir pressure = 2,500 psia
Oil viscosity = 2 cp

Problem 5.

List the five assumptions for Darcy's law [10 pts.].

Problem 6.

Show your work that 1 Darcy $\approx 9.869 \times 10^{-9}$ cm^2 [10 pts.].

Problem 7.

A reservoir is composed of serial four layers whose thickness are the same as h.

7-1. Calculate the average permeability k_{avg} for a linear flow system to the first decimal place [5 pts.]

Layer no.	Length of each layer, ft	Horizontal permeability, md
1	100	25
2	200	50
3	300	100
4	1,000	200

7-2. Calculate the average permeability k_{avg} for a radial flow system to the first decimal place. The radius of the production well is 6 in. and the effective radius of drainage area (r_e) is 1,000 ft according the table below. Note that the production well is located in the center of the layer no.1 [5 pts.]

Layer no.	Radius from the center of the well, ft	Horizontal permeability, md
1	100	25
2	200	50
3	300	100
4	1,000	200

(Example: The left and right figures are schematic diagrams for a serial linear flow system with three layers and a radial flow system with two layers, respectively.)
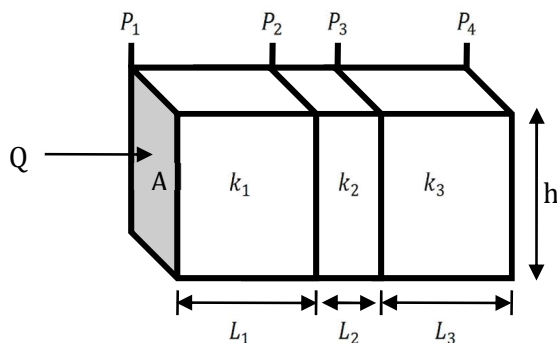
Serial linear flow
composed of three layers
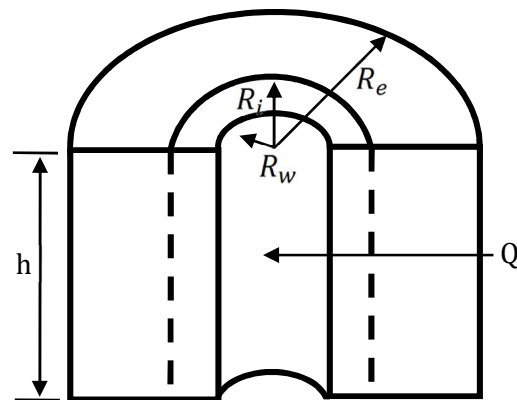
Serial radial flow composed of one
production well and two serial layers.

Problem 8.

8-1. Show your work to derive the Archie's Equation [3 pts.].

8-2. Show your work to calculate water saturation (S_w) under the following condition [3 pts.].

Cementation factor, m	2.0	Porosity, φ (fraction)	0.25
Empirical constant, a	1.0	Resistivity of formation water, R_w ($\Omega \cdot m$)	0.1
Saturation exponent, n	2.0	True formation resistivity, R_t ($\Omega \cdot m$)	40.0

Problem 9.

Define the following formation volume factors. Also, draw graphs of three formation volume factors as a function of reservoir pressure. You MUST draw the graphs with a bubble point pressure (P_b), their conventional ranges, and their units.

9-1. Oil formation volume factor (B_o) [3 pts.]

9-2. Gas formation volume factor (B_g) [3 pts.]

9-3. Solution gas/oil ratio (R_s) [3 pts.]

9-4. Let's assume that your daily oil production rate is 100 STB/day of oil.

Calculate how much the reservoir volume is drained daily, where B_o = 1.3 rb/STB, B_g = 0.004 rb/scf, R_s = 510 scf/STB, and R = 4,000 scf/STB. [5 pts.]

Problem 10.

Below is a graph for reserve estimation based on a probabilistic method. Provide appropriate names from A to J. [10 pts.].

Probabilistic Method
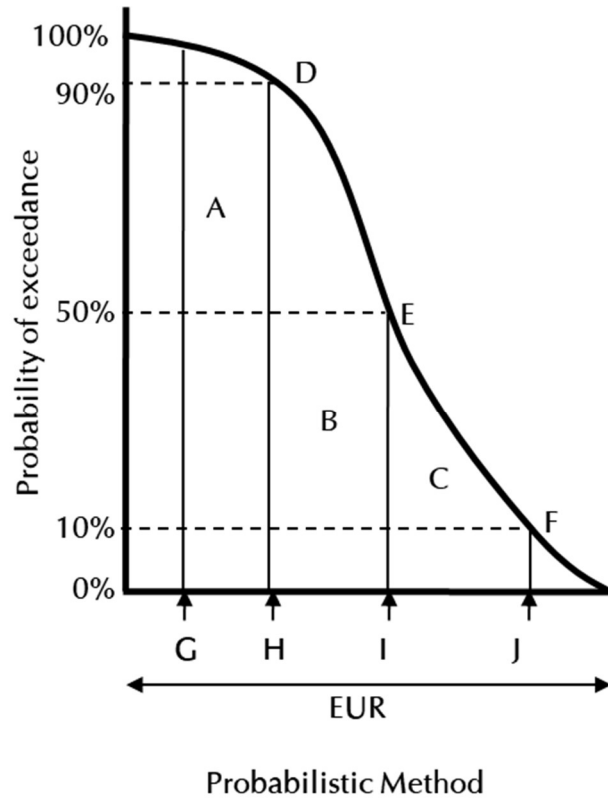
-------------------- This is the End of the Final Examination --------------------