

Petroleum Engineering 311
Test 2

January 22, 2002

1. Calculate the porosity of a limestone sample given the following data.

mass of dry sample	241.0 g
mass of dry sample coated with paraffin	249.5 g
volume displaced by coated sample	125.0 cm ³
density of limestone	2.71 g/cm ³
density of paraffin	0.90 g/cm ³

$$V_{\text{paraffin}} = \frac{8.5 \text{ g}}{0.9 \text{ g/cm}^3} \Rightarrow V_b = (125.0 - \frac{8.5}{0.9}) \text{ cm}^3 = 115.55 \text{ cm}^3$$

$$V_m \approx \frac{241 \text{ g}}{2.71 \text{ g/cm}^3} \quad \phi = \frac{V_b - V_m}{V_b} = 1 - \frac{88.93 \text{ cm}^3}{115.55 \text{ cm}^3} = \underline{\underline{0.230}}$$

2. Is the result in problem 1 above total or effective porosity? Justify your answer.

Total V_p is estimated as difference between V_b and V_m and the latter from mass and density.
Determination of V_p is not based upon fluid flow.

3. Suppose you are using a helium porosimeter to determine the matrix volume of a limestone core. The volumes Cell 1 and Cell 2 are 6000.0 cm³ each.

- a. Find the final volume if Cell 1 is initially charged with helium at 90.0 psia and the final pressure (after placement of the core in Cell 2, evacuation of Cell 2, and opening the valve) is 65.5 psia.

$$p_i V_i = p_f V_f$$

$$V_f = \frac{p_i}{p_f} V_i = \frac{90.0}{65.5} (6000) \text{ cm}^3 = \underline{\underline{8240 \text{ cm}^3}}$$

- b. What is the bulk volume of the core in cm³ if its diameter is 3 inches and its length is 3 ft?

$$V_b = \frac{\pi}{4} d^2 L = \frac{\pi}{4} (3)^2 (36) \text{ in}^3 \left(2.54 \frac{\text{cm}}{\text{in}}\right)^3 = 4170 \text{ cm}^3 \text{ or } \underline{\underline{4000 \text{ cm}^3 *}}$$

* Hopefully, the dimensions of the core will be known more precisely.