

**Utah State University**  
**Department of Civil and Environmental Engineering**  
**CEE 3430 Engineering Hydrology**

Test 1.  
D.G. Tarboton

Date: 2/15/2012  
Time: 50 min  
35 Points

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Open Book. Answer all questions. **Please answer on separate sheets of paper.** You may refer to the textbook, notes, solutions to homework and any other written or printed reference material that you have brought with you.

Calculator use. You may use a programmable calculator or equivalent calculating device (e.g. calculator functionality on a phone). You should limit the use of the calculating device to the performance of calculations. You may use programs that you have written to evaluate quantities commonly used in this class (e.g. saturation vapor pressure).

Computer use. You may use a laptop computer to access an electronic version of the textbook. You may not send emails or messages or communicate in any way with anyone other than the instructor or moderator regarding solutions to these questions.

1. A cylindrical soil sample take with an 8 cm high and 6 cm diameter tube has the following properties

Initial mass	480 g
Dry mass	430 g
Mineral density	2.65 g/cm <sup>3</sup>

Determine the following

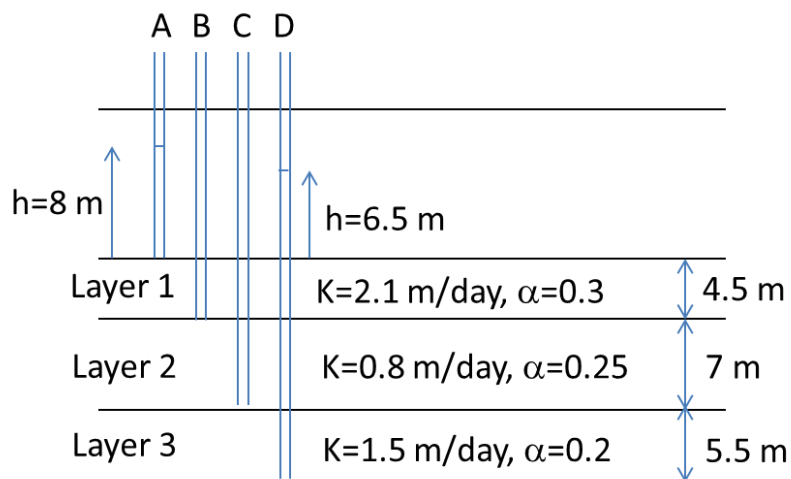
- a) Dry density
- b) Porosity
- c) Volumetric moisture content
- d) Saturation percentage

[10 points]

2. A layered aquifer has the hydraulic conductivity,  $K$ , and porosity,  $\alpha$ , values and dimensions indicated. Observation wells A, B, C and D penetrate to the top, 2<sup>nd</sup>, 3<sup>rd</sup> and bottom layer interfaces as indicated. The head in A is 8 m and the head in D is 6.5 m. Flow is saturated, steady state and vertical.

- Indicate the direction of flow (upwards or downwards)
- Calculate the equivalent vertical hydraulic conductivity
- Calculate the vertical flow rate in each layer
- Calculate the heads in observation wells B and C
- If a tracer is introduced into well B, calculate the average travel time for it to reach well C

[15 points]



3. A well fully penetrates an unconfined aquifer as indicated. The well is pumped at steady state at a rate of  $1500 \text{ m}^3/\text{day}$ . The head in the well is  $10 \text{ m}$ , and in an observation well  $40 \text{ m}$  away is  $12 \text{ m}$ . The radius of the well is  $r_w = 0.15 \text{ m}$ .
- Determine the hydraulic conductivity of the aquifer
  - Determine the head in a second observation well  $30 \text{ m}$  away

[10 points]

