

Fall 2005  
CEE 432/532  
Quiz #8 (10 minutes)

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I. Fill in the blanks:

[10]

- (a) In the upper portion of the unsaturated zone, also called vadose zone, both air and water are present in the pore spaces between mineral grains.
- (b) Respiration by soil bacteria and plant roots causes the soil air to be depleted in oxygen and to be strongly enhanced in carbon dioxide relative to atmospheric air.
- (c) The water table is defined as the depth at which pore water pressure equals atmospheric pressure.
- (d) The ease with which water is conducted through porous material is described by the parameter called hydraulic conductivity.
- (e) Aquifers are regions of saturated material that are at least moderately conductive to water and may be tapped via wells.
- (f) Sometimes the aquiclude or aquitard is thin and has unsaturated material beneath it. In such a case the aquifer and the water table are said to be perched.
- (g) Hydraulic conductivity,  $K$ , is usually determined experimentally. It varies over many orders of magnitude in the subsurface environment, from values as high as 1 cm/sec for coarse gravel, to  $10^{-3}$  cm/sec for fine sands, to  $10^{-5}$  cm/sec or lower for nearly impermeable clays.
- (h) Hydraulic conductivity can be measured in situ by observing the response of wells to pumping (a.k.a. pumping tests) or to instantaneous additions or removal of water (a.k.a. slug tests).
- (i) Typical aquifer porosities are in the range of 0.2 to 0.4.
- (j) The equation of the transport of a conservative tracer can be readily modified by a retardation factor so that they describe the behavior of a sorbing chemical.