CE 5364 Groundwater Transport Phenomena
Exam 1 (Alternate) , Fall 2024

Students should write their name on **all sheets of paper**.
Students are permitted to use the internet to help answer questions.
Students are permitted to use their own notes and the textbook.
Students are **forbidden** to **communicate with other people** during the examination.

1. Provide short answers to the following questions:

   a) What is an adsorbtion isotherm?

   b) Why is it important in contaminant hydrology?

   c) What is the advection-dispersion equation?

   d) Why is it important in contaminant hydrology?

2. Consider the concentration profiles in Figure 1. The elapsed time is the time since the injection of a constituient bolous. Assuming the porosity is 0.50 and the initial mass of constituient is 200 mg. Determine:

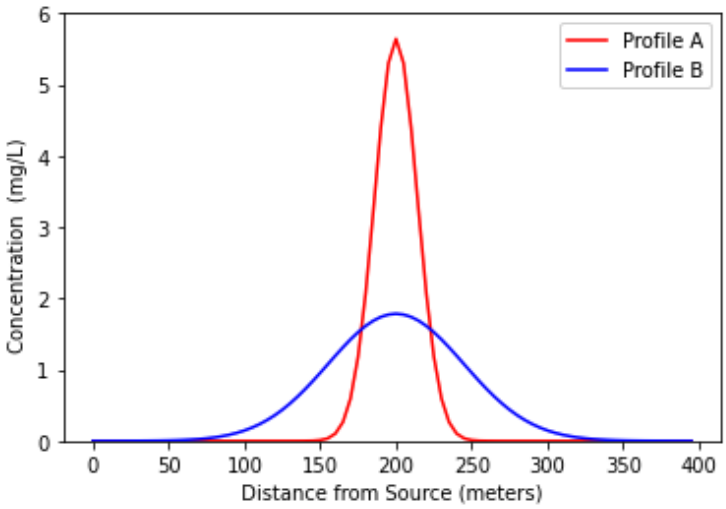

Figure 1: Concentration profile(s)

(a) The profile (A) or (B) that indicates greater dispersive behavior.

(b) The model that describes the type of transport indicated by the profile.

(c) The pore velocity and apparent dispersion for each profile.

Continued (show work here)

3. Consider the concentration histories in Figure 2. The elapsed time is the time since the release of the constituients. The observation location is 100 meters away from the source zone. Determine:

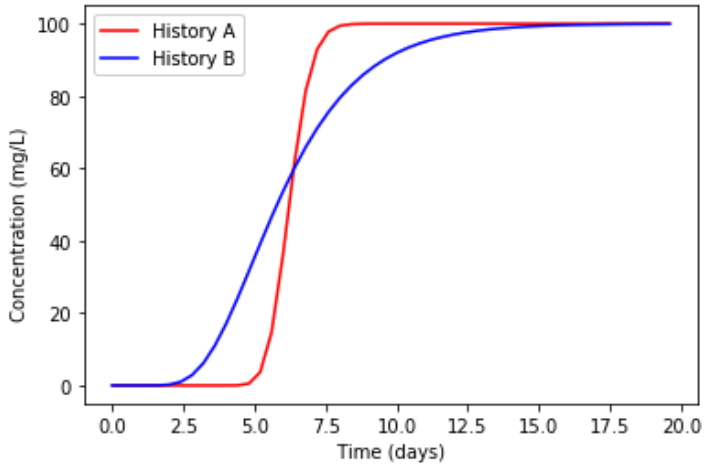

Figure 2: Concentration histories

(a) The history (A) or (B) that indicates greater dispersive behavior.

(b) The model that describes the type of transport indicated by the history.

(c) The pore velocity and apparent dispersion for each history.

Continued (show work here)

4. Assume that one-dimensional transport tools are adequate to simulate the transport of a contaminant through an aquifer depicted in Figure **??** For each situation described

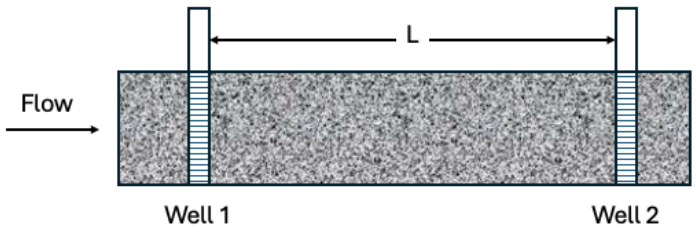

Figure 3: Aquifer Schematic

below, write the governing equation(s) (not the solutions) describing the transport (and any reactions). Sketch the expected concentration history at Well 2 for the history given at Well 1.

(a) Constant source; no dispersion, reactions, or decay.

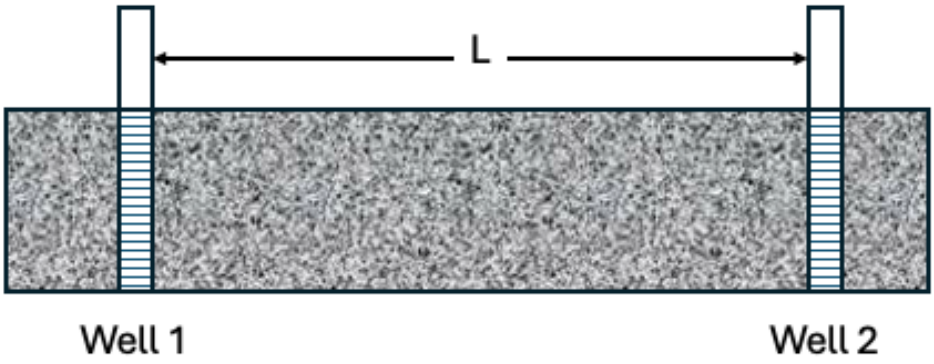

Figure 4

(b) Constant source with dispersion, no reactions, or decay.

(c) Constant source with dispersion, linear equilibrium adsorbtion, but no decay.

(d) Constant source with dispersion, linear equilibrium adsorbtion, and 1st-order decay.

(e) Finite duration source; no dispersion, reactions, or decay.

(f) Finite duration source with dispersion, no reactions, or decay.

(g) Finite duration with dispersion, linear equilibrium adsorbtion, but no decay.

(h) Finite duration with dispersion, linear equilibrium adsorbtion, and 1st-order decay.

(i) Declining source with dispersion, no reactions, or decay.

(j) Sequence of finite duration sources with dispersion, no reactions, or decay.