ENVSE 408 Guide for Assignment 1.

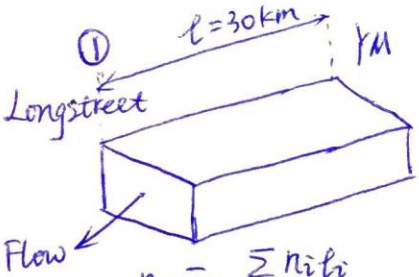
Part 1-3.

First. evaluate the darcy velocity $\boxed{v_d = -K\frac{dh}{dx}}$,

where $K = \rho g \frac{k}{\mu}$ is the hydraulic conductivity.

The advective velocity can be calculated as $\boxed{v_a = \frac{v_d}{n}}$.

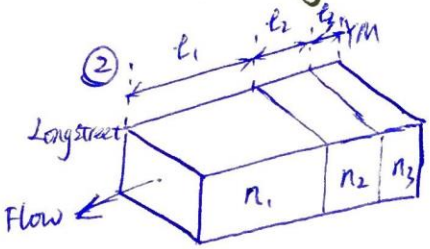
Note that v_a is the actual rate at which the contaminent is moving downstream. (n is porosity)



$$n = \bar{n} = \frac{\sum n_i \ell_i}{\sum \ell_i}$$

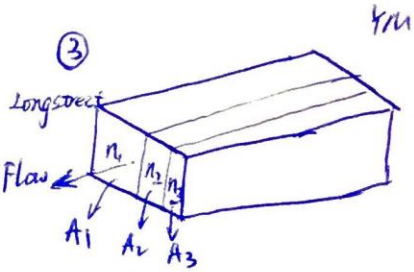
$$v_a = \frac{v_d}{\bar{n}}$$

$$t_b = \frac{\ell}{v_a}$$



v_a is different for the 3 segments.

$t_b = t_1 + t_2 + t_3$



v_a is different for the 3 stream tubes, thus they have different breakthrough times.

Discharges can be obtained by $\frac{Q}{A} = -k\frac{dh}{dx} = v_d$.

Part 5.

Darcy velocities change proportionately to permeability, so do the advective velocities.

In parallel, discharges also change with permeability.

$$\boxed{v_d = -k\frac{dh}{dx} = \frac{Q}{A}}$$