

Answers Quiz 1 (example Quiz)
ERS 100

Question 1)

$$Q_{in} - Q_{out} - E - L = \Delta S / \Delta t$$

There is no change in height, so $\Delta S = 0$

$$L = Q_{in} - Q_{out} - E$$

Based on evaporation values, the area under the curve of "Pan evaporation vs. Time" will yield the evaporation.

This turn out to be approximately $0.627 \text{ inch/day} = 5.23 * 10^{-2} \text{ ft/day}$

We have to adjust for these data using a pan coefficient of 0.7 for differences between pan and open water surface measurements.

The area that evaporates is both the area of the wetland and the area of the prefilter

$$\text{Wetland area} = 8 \text{ ft} \times 20 \text{ ft} = 160 \text{ ft}^2$$

$$\text{Pre filter area} = 4 \text{ ft} \times 2 \text{ ft} = 8 \text{ ft}^2$$

Total evaporative rate = $168 * 0.7 * 5.23 * 10^{-2} = 0.7 * 8.78 \text{ ft}^3/\text{day} = 46.0 \text{ gpd}$

$$L = Q_{in} - Q_{out} - E = 75 - 8 - 46 = 21 \text{ gpd (gallons per day).}$$

Since a flowrate is asked for, the length of time (3 days) is not important !!

Question 2)

To calculate the pressure, we need to find the height of the water column above the port location. Total depth is 4 feet, and the port is 0.5 feet above the bottom of the wetland system. The total column of water above the port is 3.5 feet. The pressure (in psi) can be calculated as:

$$p = h * \gamma$$

where h is in [m].

$$h = 3.5 * 0.304 = 1.06 \text{ m}$$

$$p = 1.06 * 9800 = 10.43 \text{ kPa}$$

$$p = \underline{1.51 \text{ psi}}$$

The oil on the right side of the manometer has a height of $3.5 + 7/12 = 4.083$ foot. = 1.24 m. This should be equal to the water pressure on the other side of the port, or:

$$1.24 * \rho_{oil} * 9.8 = 1.06 * \rho_{H2O} * 9.8$$

$$\rho_{oil} = 855 \text{ kg/m}^3 = \underline{0.855 \text{ g/cm}^3}$$

The drawing of the manometer is actually incorrect, since the interface of oil and water is shown to be exactly at the bottom of the manometer, while the bottom is below the port of the manometer. This is only correct if the bottom of the manometer is 0.5 foot above the bottom of the wetland, and not lower, as currently drawn...