Homework #3

Released: 10/17/2014 (Fri) - Due: 10/22/2014 (Wed), in class

The homework will NOT be graded, but we will check for MISSING ANSWERS and CHEATING. Note that a cheated homework will get 80% of the lowest score in the class. You can give the answers **either** in English **or** Korean.

1. [Hydrology] A lake is 12 km in length by 2.5 km in width. The inflow for the month of April is 3.26 m^3/s and the outflow is 2.93 m^3/s. The total monthly precipitation is 15.2 cm and the evaporation is 10.2 cm. The seepage out of the lake is estimated to be 2.5 cm. Estimate the change in storage during the month of April.

2. [Hydrology] A 4000-km^2 watershed receives 102 cm of precipitation in a year. The average flow of the river draining the watershed is 34.2 m^3/s. Infiltration is estimated to be 5.5×10^{-7} cm/s and evapotranspiration is estimated to be 40 cm/year. Determine the change in storage in the watershed over a year. Compute the runoff coefficient for this watershed assuming that all of the flow in the river is due to runoff.

3. [Hydrology] Two piezometers have been placed along the direction of flow in a confined aquifer that is 30.0 m thick. The piezometers are 280 m apart. The difference in piezometric head between the two is 1.4 m. The aquifer hydraulic conductivity is 50 m/day, and the porosity is 0.2. Estimate the travel time for water to flow between the two piezometers.

4. [Water quality] Look up related textbooks or the Internet to answer the following questions on different types of pollutants.

    i) List two types each of pathogenic viruses, bacteria, and protozoa and list the symptoms or diseases when humans are infected by each pathogen. (병원균으로 작용하는

바이러스, 박테리아, 원생동물을 각 2종씩 열거하고, 각 병원균에 감염되었을 때 사람에게 나타나는 증상 또는 병명을 말하시오.)

ii) List at least five different endocrine disrupting chemicals (EDCs) and draw their chemical structures. (내분비계교란물질을 최소 5가지 열거하고, 각 물질의 화학구조를 그리시오.)

iii) List at least five different chemicals that can be classified as pharmaceuticals and personal care products (PPCPs) and briefly explain the uses of each chemical. (PPCPs 로 분류될 수 있는 화합물을 최소 5가지 열거하고, 각 화합물의 용도를 간단히 설명하시오.)

5. [Water quality] Bacterial cells can be represented by the chemical formula $C_5H_7O_2N$. Compute the theoretical oxygen demand (ThOD) of a bacterial suspension with a concentration of 100 mg/L. Assume the following reactions apply.

$$C_5H_7O_2N + 5O_2 \rightarrow 5CO_2 + 2H_2O + NH_3$$

$$NH_3 + 2O_2 \rightarrow NO_3^- + H^+ + H_2O$$

6. [Water quality] You obtained following data from a BOD test:
   Diluted wastewater:

   Initial DO = 8.6 mg/L

   Final DO (after 5 days) = 2.1 mg/L

   Volume of wastewater = 2.5 mL

   Total volume in BOD bottle = 300.0 mL

   Seed control:

   Initial DO = 8.6 mg/L

   Final DO (after 5 days) = 7.3 mg/L

   Volume of seeded dilution water = 300.0 mL

   T = 20°C

Calculate the BOD$_5$ of the sample. Assuming that the ultimate BOD of the sample is 1000 mg/L, what is the BOD$_7$ of the sample?

7. [Water quality] The Audhumla town council has asked that you determine whether the discharge of the town's wastewater into the Einherjar River will reduce the DO below the state standard of 5.00 mg/L at Gotterdämmerung, 5.79 km downstream. Given the values in the table, what is the DO at Gotterdämmerung? What is the downstream distance from the town of Audhumla that will have the lowest DO? (The saturated DO concentration, DO$_s$ at 28°C is 7.92 mg/L)

Parameter	Wastewater	Einherjar River
Flow (m^3/s)	0.280	0.877
Ultimate BOD	6.44	7.00
DO (mg/L)	1.00	6.00
k$_d$ at 28°C (day^{-1})	-	0.199
k$_r$ at 28°C (day^{-1})	-	0.370
Speed (m/s)	-	0.650
Temperature	28	28