題號： 179
科目：衛生工程
節次： 8

國立臺灣大學114學年度碩士班招生考試試題

題號：179
共 2 頁之第 1 頁

1. Water pollution can be categorized into point sources and non-point sources. Answer the following questions.
   (a) Describe the important characteristics of combined sewer system for domestic wastewater collection (5 points)
   (b) Describe the important characteristics of point sources and non-point sources (10 points).

2. A residential area of 1 km² has 20% of roofs, 25% of paved driveways and walks, 20% of Portland cement streets, and the reaming area is grassy lawns. In a storm event, the rainfall intensity is 150 mm/hr. Estimate the peak runoff rate using the rational method (m³/sec). (10 points)

Runoff coefficients for various surfaces	
Type of surface	C
Roofs	0.7
Paved driveway and walks	0.8
Portland cement streets	0.85
Grassy lawns	0.1

3. A new community withdraws groundwater from a confined aquifer for secondary water usage as shown in the figure below. The groundwater flows horizontally when water is withdrawn from the well.
   (a) The flow of groundwater can be described by the Darcy's Law. Please present the factors influencing the groundwater flow velocity in an aquifer. (10 points)
   (b) Please derive the relationship between the well discharging flowrate (Q) and hydraulic conductivity (K), aquifer thickness (m), radius of influence (R), radius of well (r), and well drawdown (s) for the confined aquifer. It is known that the hydraulic conductivity is 35 m/day, the confined aquifer thickness is 40 m, the radius of influence is 500 m, and the well radius is 0.3 m. What is the well drawdown if the well discharging flowrate is 1500 CMD? (15 points)
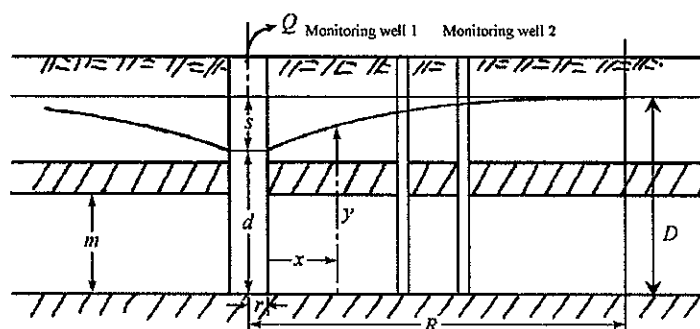
4. Describe the mechanisms for particle destabilization in surface water treatment. (7%)

5. Compare the similarities and differences between <u>adsorption</u> and <u>ion exchange,</u> addressing their mechanisms for contaminant removal contaminant and providing an example of each in water treatment. (8%)

6. Describe the concept of <u>chloride breakpoint curve,</u> the role of ammonia, and the type of chloride residual present in various regions (i.e., pre-breakpoint, approaching the breakpoint, and post-breakpoint). (8%)

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題號： 179
共 2 頁之第 2 頁

7. Why the sludge retention time is crucial in the activated sludge process of a wastewater treatment? (6%)

8. Describe the three stages of anaerobic digestion, in which sludge is stabilized and broken down into simpler compounds, producing biogas. (6%)

9. Nitrogen removal from municipal wastewater is achieved through nitrification and denitrification. Sketch a flow diagram and describe the nitrification and denitrification processes, explaining how they fit into the overall process train of municipal wastewater treatment. (15%)

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