

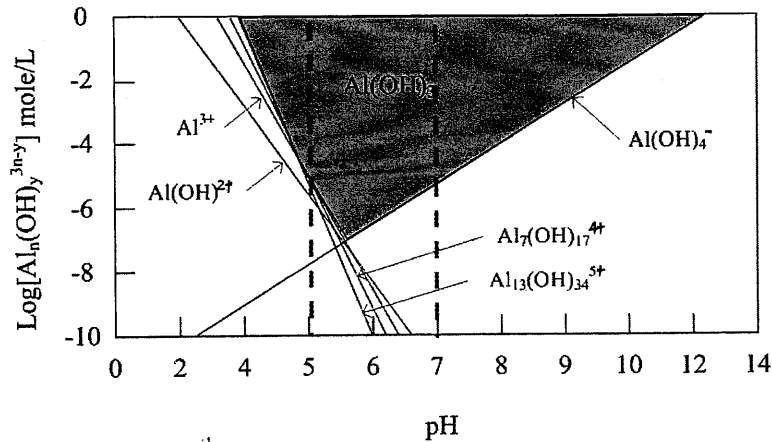
※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Answer the following questions or explain the terms.

(1) List 5 factors that affect the runoff coefficient. (5%)

(2) Given the logC-pH plot as follows, what is the optimal pH in coagulation using alum as the coagulant?

Explain why. (5%)



(3) What are the assumptions of an ideal sedimentation tank? (5%)

(4) What are the factors in influencing the drinking water disinfection efficiency? (5%)

(5) For a negatively charged colloid in an electrolyte solution, please draw the distribution of electrolyte ions and the surface (electrostatic) potential changes from the colloid surface. Indicate the specific surface potentials introduced in class. (10%)

2. The following data have been obtained in a BOD test that is made to determine how well a wastewater treatment plant is operating:

	Initial D.O. (mg/L)	Final D.O. (mg/L)	Volume of wastewater (mL)	Volume of dilution water (mL)
Untreated sewage	6.0	2.0	5	295
Treated sewage	9.0	4.0	15	285

What percentage of the BOD is being removed by this treatment plant, assuming that this particular BOD test could measure 100% of the pollutants in the wastewater? If this is a secondary treatment plant that is supposed to remove 85% of the BOD, would you say it is operating properly? (15 points)

3. In the coagulation reaction, alum $[Al_2(SO_4)_3 \cdot 14.3 H_2O]$ (molecular weight = 599.4 g/mole) reacts with natural alkalinity or can be reacted with soda ash (Na_2CO_3) (Na atomic weight 23) if water is deficient in alkalinity. Calculate the mg/L amounts of alkalinity (as $CaCO_3$) and soda ash that react with 1.0 mg/L alum. (15%)

4. A well is producing from a confined aquifer at steady state. An observation well 100 m away from the pumping well shows a *drawdown*, s_2 of 5 m, while an observation well 20 m away from the pumping well shows a *drawdown*, s_1 of 16 m. (1) If the well produces at a rate $Q = 20 \text{ m}^3/\text{min}$, what is the transmissivity (m^2/min) of the aquifer? (2) In the case where the pumping rate is unknown, what would be the drawdown, s_w at the pumping well of radius 0.2 m? (15%)
5. What is the corresponding overflow rate (express unit of m/day and rounding to integer 四捨五入到整數) that can just completely remove coagulated particles with a size of 0.00075 m and density of 1001 kg/m^3 ? ($\rho = 1000 \text{ kg/m}^3$, $\mu = 0.89 \times 10^{-3} \text{ kg/m}\cdot\text{s}$ at 25°C , $g = 9.8 \text{ m/s}^2$) If the flow rate is 6,000 CMD, retention time is 3 hours, design the sedimentation tank. (15%)
6. Assume that a 99.99% removal of pathogens in raw water requires a $c \cdot t$ value of $6 \text{ mg/L}\cdot\text{min}$, try to determine the size of disinfection chamber, given the residual chlorine level of 0.6 mg/L and a flow rate of $2 \text{ m}^3/\text{min}$. (10%)