

1. Explain the following two parameters for microbiological quality of drinking water:  
(1) Total coliform bacteria (2) *Escherichia coli* (*E. coli*). (10%)
2. Explain the difference in meaning for public health when water samples collected from distribution system were analyzed, and shown (1) total coliform bacteria positive, but *E. coli* negative (2) positive for both total coliform bacteria and *E. coli*. (10%)
3. What are the total trihalomethanes (TTHMs)? Where do the TTHMs in the finished water come from? How to reduce its concentration, if a water treatment plant faced TTHMs problem? (15%)
4. (1) What are the two most important parameters in the operation of rapid sand filter?  
(2) Give the reason why coagulation pretreatment is required for rapid sand filter, but not for slow sand filter. (10%)
5. What is meant by the term *equalizing storage*? What benefits does equalizing storage provide in a water distribution system? Explain briefly the methods to decide the required volume of equalizing storage. (10%)
6. Define and describe the components of (1) primary, (2) secondary, and (3) tertiary treatment for municipal wastewater. (15%)
7. A secondary sewage treatment plant, with completely mixed activated sludge process, has a capacity of 10,000 m<sup>3</sup>/d. The BOD<sub>5</sub> of the influent to the aeration tank is 300 mg/L, which must be reduced to 30 mg/L, prior to discharge to receiving water. The MLSS in the aeration tank is to be kept at 3,000 mg/L. Assume the cell yield coefficient = 0.7 kg biomass/kg BOD utilized, endogeneous decay coefficient = 0.04 d<sup>-1</sup>. The secondary clarifier is designed to thicken the sludge to 12,000 mg/L, and assume the S.S. of the effluent can be neglected. For a mean cell residence time of 8 d, determine
  - (1) The volume of the aeration tank.
  - (2) The sludge recycle ratio.
  - (3) The BOD volumetric loading rate and F/M ratio of the process.
  - (4) The wet volume of sludge wasted each day. (20%)

(Hint:  $\frac{1}{\theta_c} = \frac{Y(S_0 - S)}{\theta X} - k_d$  )
8. Explain the phenomenon of *crown corrosion* in concrete sanitary sewers, and also the preventative measures. (10%)