

1. In the civil engineering practice of structural and transportation engineering, design decisions are usually influenced by building codes and American Association of State Highway and Transportation design criteria. What is the primary influence on design decisions made by environmental engineers?
2. During which decade were virtually all of the United States federal laws pertaining to the environment enacted?
3. The following list includes all of the types of laws and regulations that govern environmental matters in the United States. List them in their hierarchy from highest to lowest.

State laws
U.S. Constitution
Federal regulations

State regulations
Federal laws
Treaties

4. A sample is to be analyzed for solids.

25 ml of the sample is placed in a drying dish and dried overnight at 105°C. The weight of the empty dish is 13.1066 g. The weight of the dish after drying is 13.1108 g. What is the total solids concentration in the sample in mg/l?

100 ml of the sample is filtered through a glass fiber filter and dried overnight at 105°F. The weight of the clean filter is 0.8511 g. The weight of the dried filter is 0.8631 g. What is the suspended solids concentration in the sample in mg/l?

The same glass fiber filter is then placed in a muffle furnace at 550°C for one hour. The weight of the filter after processing in the muffle furnace is 0.8571 g. What is the volatile suspended solids concentration in the sample in mg/l?

5. A sample is to be analyzed for BOD₅. The BOD₅ concentration is believed to be between 100 mg/l and 400 mg/l.

How many different sample volumes should be tested?

What volumes of sample should be used in the test?

6. One BOD bottle had an initial 8.8 mg/l dissolved oxygen concentration and a 4.1 mg/l dissolved oxygen concentration after 5 days of incubation. The bottle had been incubated with 5 ml of sample.

Another BOD bottle had an initial 8.7 mg/l dissolved oxygen concentration and a 0.3 mg/l dissolved oxygen concentration after 5 days of incubation. The bottle had been incubated with 10 ml of the same sample.

What is the estimated BOD₅ value for the sample?

7. A TOC analysis reveals that a sample has a TOC concentration of 68 mg TOC/l. What is the estimated oxygen demand of this sample?
8. In order to determine the mixing zone in a river downstream from the outfall of a municipal wastewater treatment plant, a conservative (non-reactive) tracer will be injected into the treated effluent from the wastewater treatment plant just prior to the outfall pipeline's flow entering the river. The equipment used to measure the tracer cannot detect a concentration below 0.1 mg/l. The tracer has a 50,000 mg/l concentration. The river has a $189 \frac{FT^3}{SEC}$ flow rate during the tracer test. What minimum pumping rate in gallons per minute must the pump used to transfer tracer into the outfall pipeline have to be to insure that the tracer concentration at the end of the mixing zone is at least within the capabilities of the equipment used to measure tracer concentration. You may assume that the capacity of the tracer pump is negligible when compared to the flow in the river.
9. Chlorine is used as a disinfectant at a wastewater treatment plant. In order for the chlorine to kill all of the harmful bacteria in the chlorine contact chamber, it must be at a 1.0 mg/l concentration when it leaves the chlorine contact chamber to enter the outfall pipeline to the river. The discharge permit restricts the chlorine concentration in the effluent discharged to the river to a maximum 0.5 mg/l concentration. If the outfall pipeline is considered a plug flow reactor and it has a 36-inch inside diameter, how long must the outfall pipeline be if the flow rate in the pipeline is 4.0 MGD and the chlorine entering the pipeline has a 0.5 day^{-1} decay rate? List all assumptions.

10. A city gets its water supply from two sources. Source "A" has the following characteristics, which have been confirmed to be accurate.

Flow rate	6.0 MGD
pH	7.2 units
Ca ⁺⁺	27.0 mg/l
Mg ⁺⁺	11.1 mg/l
Na ⁺	38.0 mg/l
K ⁺	18.0 mg/l
HCO ₃ ⁻	192.8 mg/l
SO ₄ ⁻²	119.0 mg/l
Cl ⁻	39.0 mg/l

When demand exceeds 6.0 MGD, the city supplements source "A" from source "B". Source "B" has the following characteristics, which have been confirmed to be accurate.

pH	8.3 units
Ca ⁺⁺	62.0 mg/l
Mg ⁺⁺	23.1 mg/l
Na ⁺	20.0 mg/l
K ⁺	16.4 mg/l
HCO ₃ ⁻	192.0 mg/l
SO ₄ ⁻²	81.6 mg/l
Cl ⁻	25.2 mg/l

The city does not want to allow the total hardness of its water supply to exceed 150 mg/l as CaCO₃. What is the maximum flow rate in MGD that can be utilized from source "B" to supplement a 6.0 MGD supply rate from source "A" without exceeding this hardness criteria?

What will the pH value be for the combined water sources if source "B" is utilized at its maximum allowable flow rate?

11. The laboratory reports that the concentration of ammonia as nitrogen in a sample is 3.4 mg/l. The pH value of the sample is 5.5 units. In what form is almost all of this ammonia? Could this sample be toxic to aquatic organisms?

12. What naturally occurring atmospheric gas contributes to the alkalinity in most natural surface water?