Question Bank

Subject: Environmental Quality Monitoring & Analysis(BTCHC802A)

Department: Chemical/Petrochemical Engineering

Q. 1. The following test results were obtained for a sample taken at the wastewater head works to a wastewater-treatment plant. All of the tests were performed using a sample size of 100 mL. Determine the concentration of total solids, total volatile solids, suspended solids, volatile suspended solids, total dissolved solids, and total volatile dissolved solids. The samples used in the solids analyses were all either evaporated, dried, or ignited to constant weight.

Given Data: Tare mass of evaporating dish 53.5433 g.

Mass of evaporating dish plus residue after evaporation at 105^0C=53.5794g.

Mass of evaporating dish plus residue after ignition at 550^0 C = 53.5625 g.

Tare mass of Whatman GF/C filter after drying at 105^0 C = 1.5433 g.

Mass of Whatman GF/C filter and residue after drying at 105^0 C = 1.5554 g.

Mass of Whatman GF/C filter and residue after ignition at 550^0C= 1.5476 g.

Q. 2. For a section of a river, the inlet concentration of a chemical A in water is 50 mg/L at a flow rate of 30 L/s. Using a steady state box model, estimate the concentration of A exiting this section. The rate of absorption of A into the water from air was 10 mg/s, and the rate of reaction of A in the section was 2 mg/s. Report the concentration in mg/L up to 2 decimal places.

Q.3. What is Sampling? What is the objectives of Sampling? State and explain the types of sampling?

Q.4. Arrange the following with reference to the diffusion coefficient (D) of chemical A present in different phases (1-air, 2-water, 3-soil)

(a) $D_{A1}<D_{A2}<D_{A3}$

(b) $D_{A1}>D_{A2}<D_{A3}$

(c) $D_{A1}<D_{A2}<D_{A3}$

(d) $D_{A1}>D_{A2}>D_{A3}$

Q.5. The overall mass transfer flux is a sum of flux by bulk flow and flux by molecular diffusion. With reference to this, which of the following is true for mass transfer in environmental systems.

(a) In fast flowing rivers, the magnitudes of pollutant transfer due to bulk flow dominates that of molecular diffusion

(b) In groundwater, the magnitudes of pollutant transfer due to bulk flow can be neglected

(c) In Lake, pollutant transfer occurs due to molecular diffusion alone

(d) In unsaturated soil, the predominant mechanism of mass transfer of vapor phase pollutants is by molecular diffusion.

(e) In sediment, the magnitudes of pollutant transfer due to bulk flow can be neglected

(f) In ocean, the magnitudes of pollutant transfer due to bulk flow can be neglected.

Q.6. Liter of a water sample was extracted with 50 mL of a solvent and then all of the 50 mL was separated and concentrated to 0.5 mL. 1 microliter of this final concentrated extract was injected into an analytical instrument and a concentration of 1 μg/L was obtained, what is the concentration of the water in ng/L?

Q.7. What is partition constant? What is the relation between the partition constant and Henry's Law constant? Give the nomenclature for the air-soil partition constant of a chemical A.

If the concentration of an organic chemical A in water is 5 mg/L and the equilibrium concentration of A in the air is 2000 mg/m^3. Estimate the air-water partition constant?

Q.8. What is the relation between the partition constant and Henry's Law constant? If the concentration of an organic chemical A in water is 5 mg/L and the equilibrium concentration of A in the air is 2000 mg/m^3. Estimate the air-water partition constant?

Q.9. The following test results were obtained for a sample taken at the wastewater head works to a waste water treatment plant. All of the tests were performed using a sample size of 50 mL. Determine the concentration of total solids, total volatile solids, suspended solids, volatile suspended solids, total dissolved solids, and total volatile dissolved solids. The samples used in the solids analyses were all either evaporated, dried or ignited to constant weight.

Given Data: Tare Mass of evaporating dish 53.5433 g.

Mass of evaporating dish plus residue after evaporation at 105^0C = 53.5794g.

Mass of evaporating dish plus residue after ignition at 550^0 C = 53.5625 g.

Tare mass of Whatman GF/C filter after drying at 105^0 C = 1.5433 g.

Mass of Whatman GF/C filter and residue after drying at 105^0 C = 1.5554 g.

Mass of Whatman GF/C filter and residue after ignition at 550^0C= 1.5476 g.

Q.10. What is Solubility? Calculate the solubility of air in water at 0^0 C and 1 atm. pressure. Assume other dissolved material is negligible.

Q.11. What do you mean by BOD and give its significance? What are the advantages of COD determination over BOD determination?

Determine the theoretical BOD/COD, BOD/TOC, and TOC/COD ratios for the following compound $C_5H_7NO_2$. Assume the value of the BOD first-order reaction rate constant is (0.23/d base e) (0.10/d base 10).

Q.12. What is Sampling? State the name of Sampling and explain in short.

Q.13. What do you mean by environment? What is pollutant?

Q.14. What is meant by primary pollutant and secondary pollutant? Explain with examples.

Q.15. What is Environment Monitoring? State and explain the types of Environmental Monitoring.

Q.16. What is partition constant? What is the relation between the partition constant and Henry's Law constant? Give the nomenclature for air-soil partition constant of a chemical A?
If the concentration of an organic chemical A in water is 5 mg/L and the equilibrium concentration of A in air is 2000 mg/m^3. Estimate the air-water partition constant?

Q.17. What are the physical characteristics of Waste water? State and Explain it.

Q.18. What do you mean by BOD and give its significance? What are the advantages of COD determination over BOD determination?

Q.19. Determine the theoretical BOD/COD, BOD/TOC, and TOC/COD ratios for the following compound $C_5H_7NO_2$. Assume the value of the BOD first-order reaction rate constant is 0.23/d (base e) (0.10/d base 10).

Q.20. Which are the objectives can be evaluated directly (without using any other additional data) using a time series analysis of PM_{10} on a road side location? Which of the following is a desired characteristic of a surrogate standard?

Q.21. In the application of the box model for a segment of a river with the water containing a pollutant, A, which of the following equations is appropriate to estimate the concentration of A in water, when processes occurring in the river are evaporation and reaction of A? Assume no other input or output of water.

Q.22. Which dimensionless number represent the ratio of convective mass transport to the diffusive mass transport?

Q.23. For the flat plate boundary layer theory for mass transfer from solid surface to air,

the correlation is as follows:

$N_{SH} = 0.664\ (N_{RE})^{0.8}(N_{SC})^{0.33}$; For laminar flow, $N_{RE} < 5 \times 10^5$

$N_{SH} = 0.036\ (N_{RE})^{0.8}(N_{SC})^{0.33}$; For turbulent flow, $5 \times 10^5 < N_{RE} < 5 \times 10^8$

$N_{SH} = {}^3k_{A1}L/D_{A1}$

Estimate the gas-side soil-air mass transfer coefficient, ${}^3k_{A1}$, for chemical A, in cm/h assuming a fetch of 10m. Relevant properties: Diffusivity of A in air: 6×10^{-6} m^2/s; density of air is 1.3 kg/m^3; viscosity of air is 2×10^{-5} kg/m-s; velocity of air is 1 m/s.

Q.24. Consider a Dense Non-Aqueous Phase Liquid (D-NAPL) spill on a water body such as a river or a lake. Which are the possible processes that the D-NAPL spill could be subjected to?

Q.25. What is pollutant? What are their types?

Q.26. What do you mean by COD? What are the advantages of COD determination over BOD determination?

Q.27. Which of the following is a common assumption about TDS?

Q.28. Which is a possible mechanism of sample gain during the sample collection and analysis of environmental matrices?

Q.29. What are the methods are used to measure the percentage of recovery of analytes of interest?

Q.30. If the bulk density of sediment is 1500 kg/m^3 and the total volume of the sediment in the analysis is 10 m^3, what is the moisture content of the sediment in mass of moisture / mass of wet sediment? Particle density of solid (ρ_3) is 2200 kg/m^3 and density of water (ρ_2) is 1000 kg/m^3. (Give answer upto 2 decimal places)

Q.31. Which mechanisms of chemical release from sediments to water are used?

Match the following dimensionless numbers with their corresponding definitions

Q.32.

Dimensionless number	**Definition**
1. Reynolds number	A) ${}^{1}k_{A2}L/D_{A2}$
2. Schmidt number	B) $\mu_1/\rho_1 D_{A1}$
3. Sherwood number	C) $v_1 L\rho_1/\mu_1$
	D) ${}^{1}k_{A2}L/D_{A1}$
	E) $\mu_1/\rho_2 D_{A2}$

(a) 1-C; 2-A; 3-B

(b) 1-D; 2-A; 3-B

(c) 1-C; 2-B; 3-A

(d) 1-B; 2-E; 3-D

(e) 1-E; 2-B; 3-A

Q.33. Which dimensionless number represent the ratio of inertial force to viscous force?