

Option E: Environmental Chemistry – Worksheet 2

Answer the following questions on a separate sheet of paper. **Do not** write your answers in complete sentences. **Do** write legibly.

1.
 - a. List three major and three minor elements present in the Earth's crust.
 - b. List the four components of soil and identify the one in the largest amount and its source.
 - c. Define the term *humus* and list its carbon and nitrogen content.
 - d. Describe the structure of silica, SiO_2 , and explain the consequence of replacing one in every four tetrahedrons with Al instead of Si in the silica structure.
2. Define the terms *salinization*, *nutrient depletion* and *soil pollution*, describe how each arises, and discuss their impact on the quality of soil.
3.
 - a. Define the term *soil organic matter* (SOM).
 - b. List the composition of SOM and state how its carbon content can be measured experimentally.
4. Define the process of mineralization and describe the relevance of SOM in terms of biological, physical, and chemical functions.
5.
 - a. Calcium ions present in hard water are precipitated by adding sulfate ions. Write the net ionic equation for the reaction.
 - b. Given $K_{\text{sp}}(\text{CaSO}_4) = 3.0 \times 10^{-5} \text{ mol}^2\text{dm}^{-6}$ at 25°C , calculate its molar solubility in water.
 - c. Determine if a precipitate will form when the ion concentrations are: $[\text{Ca}^{2+}] = 1.0 \times 10^{-3} \text{ mol dm}^{-3}$ and $[\text{SO}_4^{2-}] = 1.0 \times 10^{-2} \text{ mol dm}^{-3}$.
 - d. Calculate the minimum concentration of sulfate ion required to precipitate the Ca^{2+} .
6. State the meaning of the term cation-exchange capacity (EC) and outline its importance.
7.
 - a. Use relevant equations to discuss the effects of soil pH on cation-exchange capacity and availability of:
 - i. Zn
 - ii. Al
 - b. Explain how soil pH affects the amount of phosphate ions present in solution.

8. Outline and compare the two main methods of disposing of waste.
9. List five commonly recycled materials and identify the appropriate benefits for each type of recycled material.
10. Describe the characteristics, sources, and storage methods of different types of radioactive waste.
11.
 - a. List the primary pollutants produced in photochemical smog and state their main cause.
 - b. Explain why the concentration of the primary pollutants increases in the mornings and explain the role of sunlight in the formation of chemical smog. Use appropriate equations to illustrate your answer.
 - c. State two health problems caused by chemicals in photochemical smog.
 - d. Outline three methods of reducing photochemical smog.