

※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Explain these two terms: hardness and alkalinity (5%).
2. Explain the difference between COD and BOD as well as their analytical methods (5%).
3. There are several persistent organic pollutants (POPs) listed by the Stockholm Convention. Please draw the chemical structures of some POPs such as (1) hexabromocyclododecane, (2) pentachlorophenol, (3) tetrabromodiphenyl ether, (4) pentabromodiphenyl ether, and (5) dioxin (10 %) and explain what purpose each POP was used previously and why it was banned (10%).
4. One lake was contaminated with 200 $\mu\text{g/L}$ bisphenol A (BPA). If the required removal of BPA is 90% and the first-order rate constant is 0.5 hr^{-1} at 20°C , (a) what is the required residence time for the removal of BPA? (b) Due to the sunshine, the temperature increases to 30°C . Assume the activation energy for the removal of BPA is 10 Kcal/mole. What is the residence time if the desired final concentration is $10 \mu\text{g/L}$? (20 %)
5. Explain the common oxidation states of arsenic and cadmium in soils and compare their stability and toxicity under soil environmental conditions. In addition, explain how pH and soil organic matter influence the mobility and bioavailability of heavy metals. (15 %)
6. Explain why acid digestion pretreatment is required when determining total Cd and total As in soils. Compare the aqua regia digestion and microwave-assisted digestion (primarily using HNO_3), and describe factors in each pretreatment process that may cause analytical errors. (15 %).
7. Describe the analytical principles of Inductively Coupled Plasma–Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma–Optical Emission Spectrometry (ICP-OES), and discuss their advantages and limitations for the determination of arsenic and cadmium. Additionally, describe at least three QA/QC measures used in soil heavy metal analysis and explain their purposes. (20 %)

試題隨卷繳回