1.(1) Please explain the Dobson unit? (2) How is it used in relation to atmospheric ozone levels? (3) Explain why the photochemical smog is an autocatalytic process (10 %).

2.(1) Please define BOD and COD; (2) How to measure these two parameters for water samples? (3) Explain why their values can differ slightly for the same water sample. (4) Explain what kind of water sample could have a high BOD? (5) How to measure the total organic carbon (TOC) and dissolved organic carbon (DOC) in natural water (10%)?

3.A river water sample is analyzed and the following parameters are determined at 25 ^{0}C:
Total alkalinity=5.0×10^{-4} M
Phenolphthalein alkalinity=1.0×10^{-5} M
pH=7.0
hardness=30.0 mg/L
$[Mg^{2+}]=1.0 \times 10^{-4}$ M
$K_{a2}(H_2CO_3)= 4.5 \times 10^{-7}$
$K_{a2}(H_2CO_3)= 4.7 \times 10^{-11}$
$K_{sp}(CaCO_3)= 4.6 \times 10^{-9}$
MW of Mg=24.3
MW of Ca=40
Please combine one or more these data to extract all possible single-ion concentrations to determine whether or not the water is at equilibrium with respect to the carbonate-bicarbonate system and whether or not it is saturated with calcium carbonate (10 %).

4.(1)What are the two important oxidation states of arsenic? (2) What kind of arsenic species can be found in the natural environment (please illustrate their chemical structures)? (3) Which arsenic species is the most toxic form? (4) How to detect different arsenic species in water? (5) How arsenic can be removed from the polluted water? (10 %)

5.(1) What are major sources of water pollution for dioxin? (2) What pattern of chlorinated dioxin congeners leads to the greatest toxicity (please illustrate with examples)? (3) Which is the most toxic dioxin (illustrate its chemical structure)? (4) Deduce what dioxin(s) would be produced in side reactions when if the 2,4-D herbicide was to be synthesized from 2,4-dichlorophenol. (5) Draw the structural diagram of the 3, 4', 5'-trichloro polychlorinated biphenyls (PCBs) (10%).

6.What is QA/QC in experiments? (5%) Describe five terms: accuracy, precision, detection limit, instrument detection limit and method detection limit (MDL). (5%) How do you determine the MDL for the analysis of organic compounds in soils? (10%)

7.For chromatographic methods, what are the effects of temperature variation on chromatograms? (10%) What is gradient elution? (10%)

8.A variety of catalysts can be used to chemical reduce halogenated compounds in the contaminated sites. (a) Please propose a possible reductive dechlorination pathway of trichloroethylene (TCE) to ethylene in terms of their chemical structure. (5%) (b) We assume that it is a zero-order reaction, soil is contaminated with 100 mg/kg of TCE and the rate constant is 0.1 mg/kg hr^{-1}. What is the required time if the required removal of TCE is 90%? (5%)

試題隨卷繳回