1. What are the common microbial indicators used for estimating "possible fecal contamination" and "disinfection efficiency" in "drinking" water supply? Why different indicators are used? (20 pts)

2. What is the most common electron acceptor for microbial aerobic respiration? Why? Please list 3 other possible electron acceptors for groundwater bioremediation, if it was contaminated with organic solvent. (20 pts)

3. Which section of ribosomal RNA gene is the most common one used for bacterial taxonomy identification? Why? (10 pts)

4. Explain the chemical significance of (i) Acid dissociation constant (pK_a) and (b) Octanol-water partition coefficient (K_{OW}) for the fate of pollutants in the environment. (10 pts)

5. A ground water has the following analysis. Calculate the total hardness, carbonate hardness, noncarbonated hardness, alkalinity, and construct a bar chart of the constituents. All expressed as mg/L as $CaCO_3$. (10 points)

Ca^{2+}	75 mg/L
Mg^{2+}	38 mg/L
Na^{+}	20 mg/L
K^{+}	7 mg/L
HCO_3^{-}	200 mg/L
SO_4^{2-}	109 mg/L
Cl^{-}	11 mg/L

6. A closed container has 1.0×10^{-3} M CH_3OOH. You may ignore activity corrections. Calculate the pH and speciation of this solution. (CH_3COOH: pKa = 4.76) (15 points)

7. For a solution containing 1.0×10^{-8} M total dissolved iron (Fe(III)). What fraction of the Fe precipitates in a pH 7 water? (15 points)

   Thermodynamic information:

   $Fe(OH)_{3(s)} + 3H^{+} = Fe^{3+} + 3H_2O$ $\quad *K_{s0}= 10^{-3.2}$

   $Fe^{3+} + 3H_2O = FeOH^{2+} + H^{+}$ $\quad *\beta_1= 10^{-2.2}$

   $Fe^{3+} + 2H_2O = Fe(OH)_2^{+} + 2H^{+}$ $\quad *\beta_2= 10^{-5.7}$

   $Fe^{3+} + 4H_2O = Fe(OH)_4^{-} + 4H^{+}$ $\quad *\beta_4= 10^{-21.6}$

試題隨卷繳回