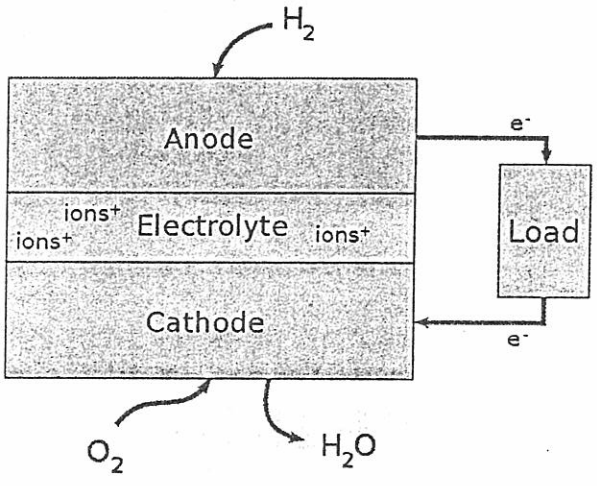
以下為簡答題，計分比重標於題尾，請作答於試卷內之「非選擇題作答區」

1. Microorganisms metabolizing carbohydrates with O_2 as a final electron acceptor are able to generate more ATP than those carrying out nitrate respiration. Why? List a few microorganisms carrying nitrate respiration. Where can you find them? (20 pts)
2. Name two microbiologically mediated biogeochemical processes occurred in our global ecological system (10 pts)
3. Consider microbial metabolism of tetrachloroethene. Can the carbon be oxidized or reduced? What will be the primary bioremediation strategy for the tetrachloroethene contaminated groundwater? What are the electron donors and acceptors? (20 pts)
4. Fenton reagent was used to treat a wastewater sample contaminated with vinyl chloride (chemical formula: CH_2CHCl) in a laboratory-scale reactor by a master student. The concentration of vinyl chloride was 5.0 mg L^{-1} initially and dropped down to 2.0 mg L^{-1} after 10 days. The solution was free of chloride initially and the final concentration of chloride in the solution was 0.85 mg L^{-1}. The student claimed that 60% of the contaminant was oxidized to carbon dioxide and water in 10 days by this method. Do you believe it? Describe the reason for your judgment. (10 pts)
5. Anastas and Warner (1998) have formulated the 12 Principles of Green Chemistry. Please list five of the principles of them or what ever your think is green. (10 pts)
6. Why HCFCs (hydrochlorofluorocarbons), an example is CHF_2Cl (or HCFC-22), can be the temporary replacements for CFCs (chlorofluorocarbons), for less potential of ozone depletion. (5 pts)
7. Given that the acid dissociation constant K_{a1} for sulfurous acid (H_2SO_3) is 1.7 x 10^{-2}, K_{a2} for bisulfite ion (HSO_3^-) is 1.2 x 10^{-7}, calculate the concentration of total SO_3(-II) (including H_2SO_3, HSO_3^-, SO_3^{2-}) that is present in the raindrops of pH 4.4. If the K_H for $[H_2SO_3]/P_{SO2}$ is 1.0 M atm^{-1}, what is the concentration of SO_2 in the atmosphere. (15 pts)
8. What are the oxidation-reduction half reactions occur in a hydrogen-oxygen fuel cell (see the schematic diagram) at anode and cathode? Write down the balanced half reactions. What ion(s) must be crossing the permeable membrane and solution of electrolytes in between two electrodes? What will be the theoretical voltage that this fuel cell can provide with initial pH at 7.0, temperature at 25 C, P_{H2} = 1 atm, P_{O2} = 1 atm, $pe^0_{(O2-H2O)}$ = 20.75, $pe^0_{(H+-H2)}$= 0? Note that $pe^0 = 16.9\ E_H^0$, cell voltage = $E_H^2 - E_H^1$ = $2.3(RT/F)(pe_2 - pe_1)$. (10 pts)



見背面

Supplementary material：

(1)Atomic weight

H = 1, O = 16, C = 12, Cl = 35.45,

(2)Constants

R = 8.314 $Jmol^{-1}K^{-1}$, F = 96490 C mol^{-1}

(2)指數及對數運算表

運算	數值	運算	數值	運算	數值
$10^{0.1}$	1.26	log 1	0	ln 2	0.69
$10^{0.2}$	1.58	log 2	0.30	ln 3	1.10
$10^{0.3}$	2.00	log 3	0.48	ln 4	1.39
$10^{0.4}$	2.51	log 4	0.60	ln 5	1.61
$10^{0.5}$	3.16	log 5	0.70	ln 6	1.79
$10^{0.6}$	3.98	log 6	0.78	ln 7	1.95
$10^{0.7}$	5.01	log 7	0.85	ln 8	2.08
$10^{0.8}$	6.31	log 8	0.90	ln 9	2.20
$10^{0.9}$	7.94	log 9	0.95	ln 10	2.30

ln(a)= log(a)/log(e), e = 2.718, log(e) = 0.4343

試題隨卷繳回