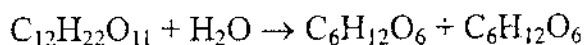


18% (一) Explanation (three points each)

- (1) Gibbs free energy
- (2) break-point chlorination
- (3) Fick's law
- (4) zeta potential
- (5) nucleation and crystal growth
- (6) Arrhenius equation

8% (二) Explain why $K_2Cr_2O_7$, $HgSO_4$, Ag_2SO_4 and sulfamic acid are normally added into the sample when COD is determined.8% (三) The enzymatic degradation of sucrose to glucose and fructose proceeds at $25^\circ C$ as follows (Given: the initial concentration of sucrose = 1.0 mole/L):

Time (min)	0	30	60	90	120
Sucrose degraded (mole/L)	0	0.1	0.2	0.3	0.4

8% (四) Theoretically calculate the pH of distilled water that is equilibrated with the atmosphere ($pCO_2 = 10^{-3.5}$ atm). (Given the constants ($25^\circ C$): pK_H (for CO_2) = 1.5; pK_{a1} (for HCO_3^-) = 6.3; pK_{a2} (for CO_3^{2-}) = 10.25)8% (五) Calculate the potential of a platinum electrode immersed in a solution prepared by saturating 0.0100 M KBr with Br_2 .**Standard Electrode Potentials***

Reaction	E° at $25^\circ C$, V
$Cl_2(g) + 2e \rightleftharpoons 2Cl^-$	+1.359
$O_2(g) + 4H^+ + 4e \rightleftharpoons 2H_2O$	+1.229
$Br_2(aq) + 2e \rightleftharpoons 2Br^-$	+1.087
$Br_2(l) + 2e \rightleftharpoons 2Br^-$	+1.065
$Ag^+ + e \rightleftharpoons Ag(s)$	+0.799
$Fe^{3+} + e \rightleftharpoons Fe^{2+}$	+0.771
$I_3^- + 2e \rightleftharpoons 3I^-$	+0.536
$Cu^{2+} + 2e \rightleftharpoons Cu(s)$	+0.337
$Hg_2Cl_2(s) + 2e \rightleftharpoons 2Hg(l) + 2Cl^-$	+0.268
$AgCl(s) + e \rightleftharpoons Ag(s) + Cl^-$	+0.222
$Ag(S_2O_3)_2^{3-} + e \rightleftharpoons Ag(s) + 2S_2O_3^{2-}$	+0.017
$2H^+ + 2e \rightleftharpoons H_2(g)$	0.000

(背面仍有題目,請繼續作答)

(六) 解釋名詞：每題 3 分 (15 分)

1. co-metabolism
2. diauxic growth
3. AMES test
4. Xenobiotic compounds
5. chemostat (continuous culture)

(七) 問答題 (35 分) 每題 7 分

1. 微生物之基因傳送 (gene transfer) 方式有那幾種?
要述之, 何謂基因重組 (gene recombination)? 簡述其過程。
2. 何謂光合自營 (photo-autotrophic)、化學自營 (chemo-autotrophic) 及化學異營 (chemo-heterotrophic) 微生物? 說明其利用 C, N 及能量之異同處, 並各舉一代表菌屬說明其在環境中所扮演之角色。
3. 以圖示自然界之碳, 氮循環, 並列舉各生化反應名稱及該些反應之微生物名稱。
4. 以圖示詳細說明呼吸作用 (respiration) 及光合作用 (photosynthesis) 之完整流程及所需條件。
5. 比較好氧 (aerobic) 及厭氧 (anaerobic) 生物處理污水之處理程序及主要微生物種類之生化反應差異。