

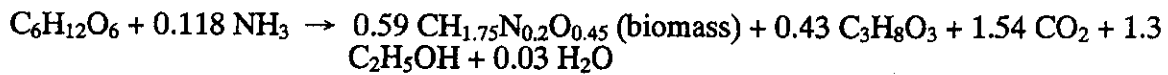
系所組別： 環境工程學系丙組

考試科目： 普通化學

考試日期： 0307 · 節次： 1

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1. **Chemical Reaction Stoichiometry** Yeasts are used to convert glucose to produce biomass, glycerol, and ethanol by the following overall reaction under anaerobic conditions.



Calculate (1) the theoretical biomass yield in g of biomass per g of glucose, (2) the ethanol yield in g of ethanol per g of glucose. Please comment on how to maximize the ethanol yield through this biochemical reaction (20 pts)

2. **Solubility.** The aqueous concentration of trichloroethene (TCE) is measured to be 20 mg/L. The water (25°C) is in contact with a dense non-aqueous-phase liquid (DNAPL) containing TCE. Assuming Henry's and Raoult's law hold, estimate the mole fraction of TCE in the DNAPL. At 25°C, Henry's constant for TCE is 11.6 atm-L/mol and the vapor pressure of pure TCE is 0.0977 atm. (15 pts).

3. **Chemical Reaction Kinetics.** A treatability study is run to investigate the rate at which a hazardous chemical can be treated. The following data are collected at 25°C. (a) Is this a zero-, first- or second-order reaction? (b) What is the rate constant for this reaction? (c) What is the half-life for this reaction? (d) How long will it take for 99% of the chemical to be removed? (25 pts).

Time (days)	Concentration of Chemical (mg/L)
0	1
1	0.81
3	0.56
5	0.36
7	0.22
10	0.14

4. **Enzyme Kinetics** Assuming that enzyme kinetics follows the model developed by L. Michaelis and M. Menten in 1913, please estimate the v_{\max} and K_m of the enzyme-catalyzed reaction for which the following data were obtained (20 pts).

[S] (M)	v_0 ($\mu\text{M}/\text{min}$)
2.5×10^{-6}	28
4×10^{-6}	40
1×10^{-5}	70
2×10^{-5}	95
4×10^{-5}	112
1×10^{-4}	128
2×10^{-3}	139
1×10^{-2}	140

(背面仍有題目,請繼續作答)

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5. **Soil-Water Partition/Equilibrium Chemistry.** Alachlor is a widely used herbicide that has a $\log K_{ow}$ of 1.4. Calculate the fraction of alachlor that will be absorbed to a flooded soil and the fraction that will be dissolved in the soil water given that the soil has an organic carbon content of 1%. The bulk density of the soils is 1.25 g/cm^3 ; this means that each cubic centimeter of soil (soil plus water) contains 1.25 g of soil particles. (Hint: $\log K_{oc} = 0.903 \times \log K_{ow} + 0.094$) (20 pts).