

EXAMPLE 1

Process design – monitoring and control strategy:

You are a process engineer and your task is to design a fed-batch cultivation process. Be prepared to describe and discuss:

- Process variables to be measured
- Process variables to be controlled
- Design of your control loops
- Set of sensors selected for monitoring and measurement principles

EXAMPLE 2

What is needed to set up a C-balance for a E. coli fed-batch process? Which measurements (on- and off-line) are required? Describe the sensor systems, measurement principle and offline-analytical methods?

EXAMPLE 3

Determination of the Ca^{2+} -concentration in a mineral water.

0, 100, 200, 300, 400, 500 μL of a Ca^{2+} standard solution were added to 50mL of 1:10 diluted water. The difference to 500 μL was compensated with distilled water. All samples were measured and the results are shown in the table

	Concentration of added standard [$\text{mgL}^{-1} \text{Ca}^{2+}$]	Signal y (Absorption)
Sample	0	0,38
Addition 1	1,98	0,48
Addition 2	3,96	0,54
Addition 3	5,94	0,59
Addition 4	7,92	0,68
Addition 5	9,9	0,73

Calculate the Ca^{2+} concentration of the mineral water

EXAMPLE 4

pO₂ calibration in a bioreactor:

After sterilization of a synthetic media calculated for moderate cell densities the bioreactor is allowed to cool down to the temperature of 25°C selected for cultivation. Before inoculation the calibration of the pO₂ probe is required. For zero point calibration N₂ and for 100% saturation air should be used as aeration gases. How would you set stirrer speed and gas flow rate and why – please discuss this question.

EXAMPLE 4

Fermentation process design		
oxygen partial pressure (1atm)	0,21	bar
Henry coefficient at 35°C	27,90	bar·m ³ /kg
Saturated dissolved oxygen concentration cO_2^*		g/L
Dissolved oxygen concentration cO_2 (DO: 30%)		g/L
Maximal working volume	20,00	L
OTR		g O ₂ /L/h
k_La	800,00	h ⁻¹
total oxygen transfer		g O ₂ /h
oxygen demand	1,60	g O ₂ /g CDM
maximal CDM production		g CDM/h
exponential feed		
growth rate	0,20	h ⁻¹
maximal final CDM		g
maximal specific CDM		g/L
batch process		
max. growth rate	0,6	h ⁻¹
maximal CDM production		g CDM/h
maximal specific CDM		g/L

Calculate the missing values in the table