

## Unit 12 - Week 10

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## Assignment 10

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2020-11-25, 23:59 IST.**

1) A person with low sugar levels in blood is given glucose drips wherein glucose solution is injected into the blood stream via venous catheter at a constant rate. As the blood is constantly flowing, the rate of transport of glucose in the direction of blood flow is much higher compared to the rate of diffusion in the same direction. Assuming the only direction of flow to be  $z$  (*axial*) and the concentration of the drug to be  $C_d$ , Which of the following represents the flow characteristics mentioned above under steady state? **1 point**

$D_{eff} \frac{\partial^2 C_d}{\partial z^2} \gg v_z \frac{\partial C_d}{\partial z}$

$D_{eff} \frac{\partial^2 C_d}{\partial z^2} \ll v_z \frac{\partial C_d}{\partial z}$

$D_{eff} \frac{\partial^2 C_d}{\partial z^2} = v_z \frac{\partial C_d}{\partial z}$

$v_z \frac{\partial C_d}{\partial z} = 0$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$D_{eff} \frac{\partial^2 C_d}{\partial z^2} \ll v_z \frac{\partial C_d}{\partial z}$

2) Let the diameter of the inner lumen of the blood vessel mentioned above be 'd', and the radial direction be 'x'. Now, consider only diffusive transport of glucose long the 'x' direction and convective transport along 'z'. Which of the following are true under steady state? **1 point**

$D_{eff} \frac{\partial^2 C_d}{\partial x^2} = v_z \frac{\partial C_d}{\partial z}$

$v_z \frac{\partial C_d}{\partial z} - D_{eff} \frac{\partial^2 C_d}{\partial x^2} = R_d$

At  $x = d$ ,  $\frac{\partial C_d}{\partial x} = 0$

At  $x = d/2$ ,  $\frac{\partial C_d}{\partial x} = 0$

No, the answer is incorrect.  
Score: 0

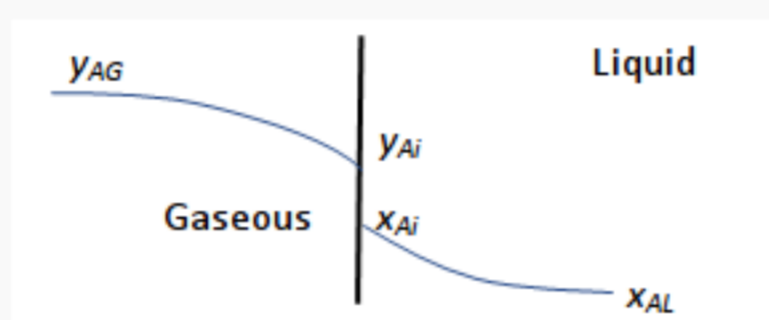
Accepted Answers:

$D_{eff} \frac{\partial^2 C_d}{\partial x^2} = v_z \frac{\partial C_d}{\partial z}$

At  $x = d$ ,  $\frac{\partial C_d}{\partial x} = 0$

3) Consider the transfer of a species A across two phases- from gas phase to liquid phase. The mole fraction of the species A is given by  $y_{AG}$  (in the gaseous phase) and  $y_{AL}$  (at the interface) and  $x_{AL}$  (at the interface) and  $x_{AL}$  (in the liquid phase) as shown below. Identify the most direct expression for the flux of A in the liquid phase **1 point**

$k_y$  and  $k_x$  are respective transfer coefficients



- $k_y(y_{AG} - y_{Ai})$
- $k_x(x_{Ai} - x_{AL})$
- $k_y(x_{Ai} - y_{Ai})$
- $k_x(x_{Ai} - y_{AG})$

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$k_x(x_{Ai} - x_{AL})$

4) Consider the gas-liquid interface as in the previous problem. At steady state, which of the following is true? **1 point**

- The flux of species A reaching the interface = The flux of species A leaving the interface
- The species A accumulates at the interface
- The flux of species A reaching the interface > The flux of species A leaving the interface
- The flux of species A reaching the interface < The flux of species A leaving the interface

No, the answer is incorrect.  
Score: 0

Accepted Answers:

The flux of species A reaching the interface = The flux of species A leaving the interface

5) The volumetric oxygen transfer capacity of a bioreactor is measured using the parameter **1 point**

- $D_{eff}$
- $k_L a$
- Reynolds number
- Schmidt number

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$k_L a$

6) Which of the following linear plots give  $k_L a$  as the slope? **1 point**

$\left( \frac{C^*}{C^* - C_{O_2}} \right)$  vs volume ' $t$ '

$\ln \left( \frac{C^*}{C^* - C_{O_2}} \right)$  vs volume ' $t$ '

$\left( \frac{C^*}{C^* - C_{O_2}} \right)$  vs time ' $t$ '

$\ln \left( \frac{C^*}{C^* - C_{O_2}} \right)$  vs time ' $t$ '

No, the answer is incorrect.  
Score: 0

Accepted Answers:

$\ln \left( \frac{C^*}{C^* - C_{O_2}} \right)$  vs time ' $t$ '

7) Which of the following instances would directly affect the value of  $k_L a$  in a bioreactor? **1 point**

- microbial substrate uptake
- Increased aeration
- Non- functioning of the agitator
- using inorganic nitrogen sources

No, the answer is incorrect.  
Score: 0

Accepted Answers:

Increased aeration

Non- functioning of the agitator

8) During the transfer of oxygen from the air bubble to the cell, the gas-liquid film is one where, **1 point**

- resistance to the transport of oxygen is high
- resistance to the transport of oxygen is very low
- turbulence exists
- oxygen transport does not occur

No, the answer is incorrect.  
Score: 0

Accepted Answers:

resistance to the transport of oxygen is high

9) While using the LPOS strategy, which of the following is the principal aim? **1 point**

- Oxygen limited growth
- increase the resistances offered to oxygen transport
- Make oxygen available to the cell at minimum resistance
- Adapt the cell to reduced oxygen environment

No, the answer is incorrect.  
Score: 0

Accepted Answers:

Make oxygen available to the cell at minimum resistance

10) Which of the following is used to estimate  $k_L a$  using dynamic response method? **1 point**

- oxidation of sulphites
- DO
- pH
- aeration rate

No, the answer is incorrect.  
Score: 0

Accepted Answers:

DO