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NPTEL

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Courses » Phase field modelling: the materials science, mathematics and computational aspects

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Unit 7 - Week 6

assignment 6

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

Due on 2018-09-12, 23:59 IST.

1) The Neumann boundary condition fixes: ***1 point***

- flux
- composition
- both flux and composition
- none of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
flux

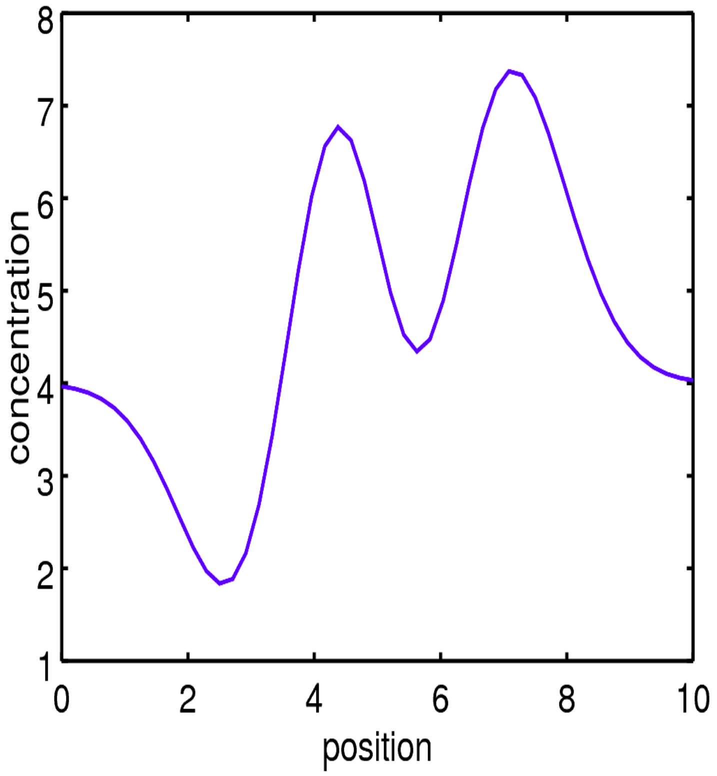
2) The implicit method is favoured over the explicit method, even though the latter is easier to implement, because ***1 point***

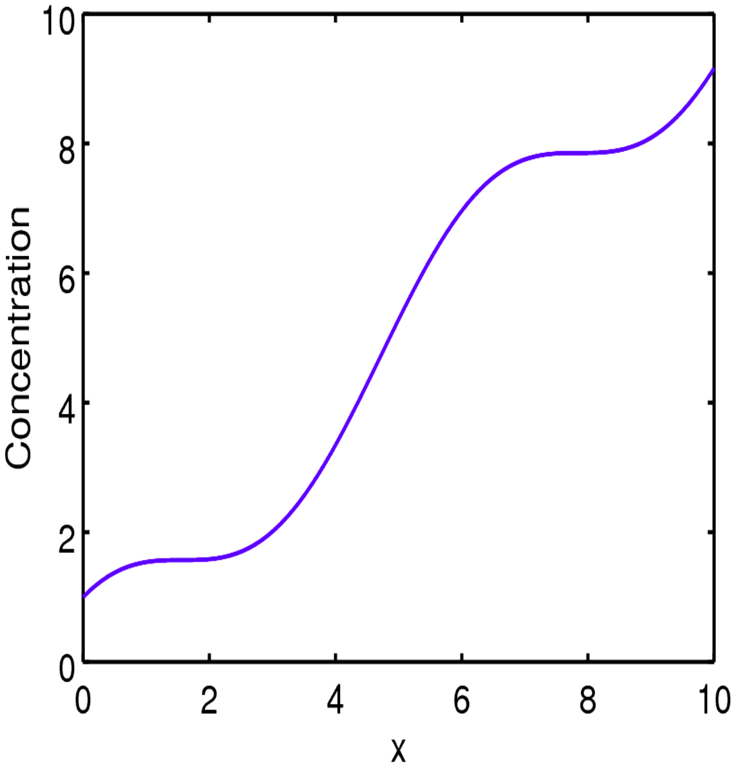
- implicit method is unconditionally stable.
- explicit method is stable only at some range of alpha
- both (a) and (b)
- none of the above

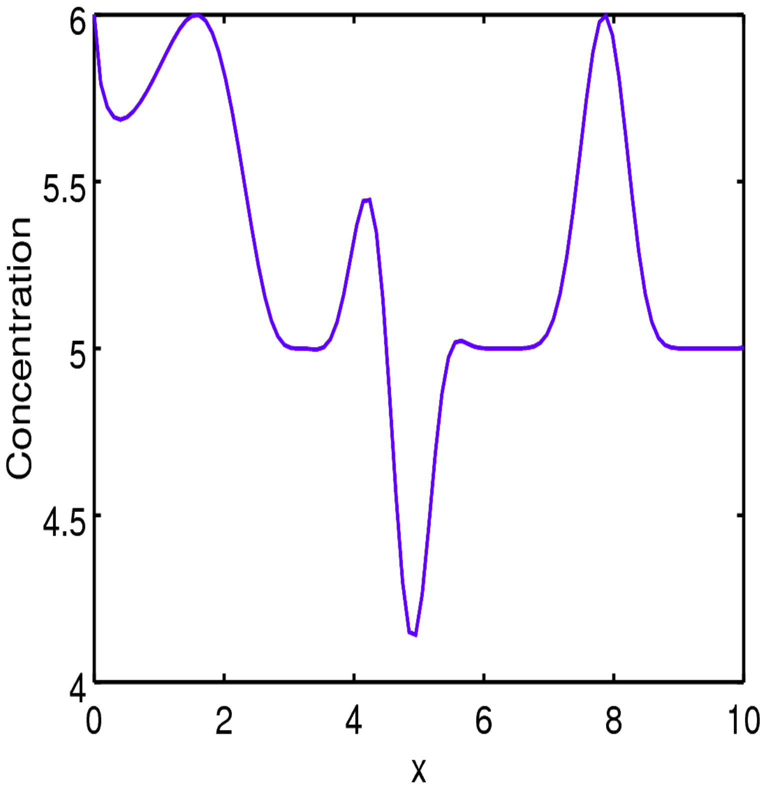
No, the answer is incorrect.
Score: 0

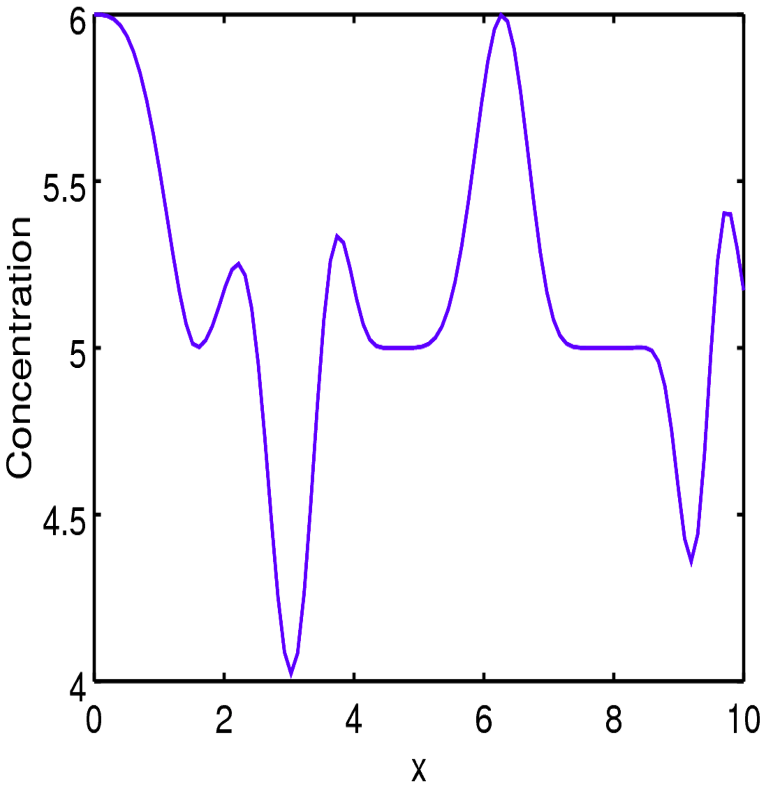
Accepted Answers:
both (a) and (b)

3) Consider the one-dimensional concentration profiles shown in the options. Which of the following belongs to a periodic system: ***1 point***


concentration
position
1
2
3
4
5
6
7
8
0
2
4
6
8
10

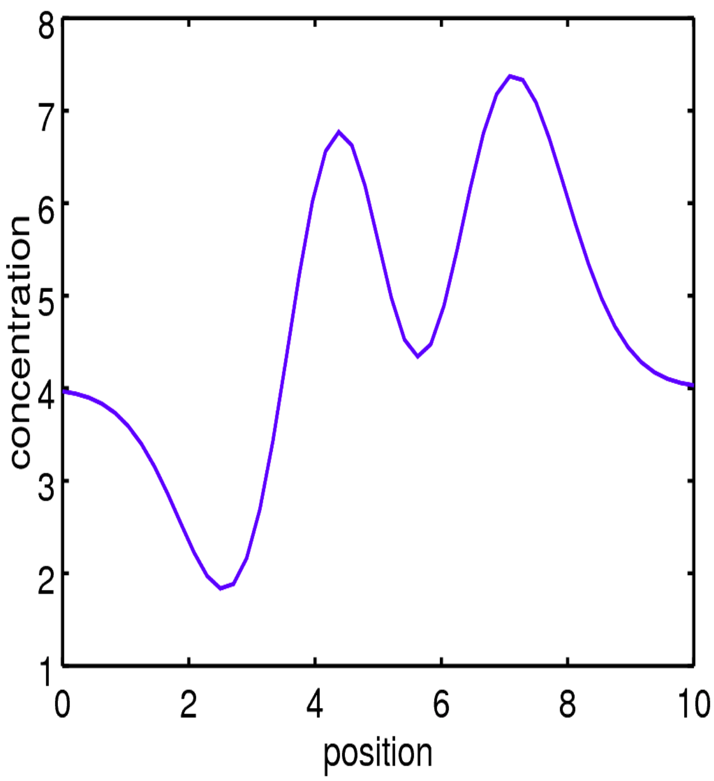

Concentration
X
0
2
4
6
8
10
0
2
4
6
8
10





No, the answer is incorrect.
Score: 0

Accepted Answers:



4) For a one-dimensional system, which of the following boundary conditions is not possible? ***1 point***

$c_l = 0; c_r = 0;$

$(\frac{dc}{dx})_l = 0; (\frac{dc}{dx})_r = 0;$

$c_l = 0; (\frac{dc}{dx})_l = 0 \quad \text{and} \quad c_r = 0; (\frac{dc}{dx})_r = 0$

$(c + \frac{dc}{dx})_l = 0 \quad and \quad (c + \frac{dc}{dx})_r = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$c_l = 0; (\frac{dc}{dx})_l = 0 \quad \text{and} \quad c_r = 0; (\frac{dc}{dx})_r = 0$

5) For solving the diffusion equation using implicit method and Dirichlet boundary conditions, the matrix used during the time integration would be: ***1 point***

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -\alpha & (1+\alpha) & -\alpha & 0 & 0 \\ 0 & -\alpha & (1+\alpha) & -\alpha & 0 \\ 0 & 0 & -\alpha & (1+\alpha) & -\alpha \\ 0 & 0 & 0 & -\alpha & (1+\alpha) \end{bmatrix}$$

$$A=\begin{bmatrix}1 & 0 & 0 & 0 & 0\\ -\alpha & (1+\alpha) & -\alpha & 0 & 0\\ 0 & -\alpha & (1+\alpha) & -\alpha & 0\\ 0 & 0 & -\alpha & (1+\alpha) & -\alpha\\ 0 & 0 & 0 & -2\alpha & (1+\alpha)\end{bmatrix}$$

$$A=\begin{bmatrix}1 & -2\alpha & 0 & 0 & 0\\ -\alpha & (1+2\alpha) & -\alpha & 0 & 0\\ 0 & -\alpha & (1+2\alpha) & -\alpha & 0\\ 0 & 0 & -\alpha & (1+2\alpha) & -\alpha\\ 0 & 0 & 0 & -2\alpha & (1+2\alpha)\end{bmatrix}$$

$$A=\begin{bmatrix}1 & 0 & 0 & 0 & 0\\ -\alpha & (1+2\alpha) & -\alpha & 0 & 0\\ 0 & -\alpha & (1+2\alpha) & -\alpha & 0\\ 0 & 0 & -\alpha & (1+2\alpha) & -\alpha\\ 0 & 0 & 0 & -2\alpha & (1+2\alpha)\end{bmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$A=\begin{bmatrix}1 & 0 & 0 & 0 & 0\\ -\alpha & (1+2\alpha) & -\alpha & 0 & 0\\ 0 & -\alpha & (1+2\alpha) & -\alpha & 0\\ 0 & 0 & -\alpha & (1+2\alpha) & -\alpha\\ 0 & 0 & 0 & -2\alpha & (1+2\alpha)\end{bmatrix}$$

6) Which of the following gives the second derivative of a composition using Central difference scheme? ***1 point***

$$c\,"=\frac{c_{i-1}-2c_i+c_{i+1}}{(\Delta x)^2}$$

$$c\,"=\frac{c_{i-1}+2c_i+c_{i+1}}{(\Delta x)^2}$$

$$c\,"=\frac{c_{i-1}-2c_i-c_{i+1}}{(\Delta x)^2}$$

$$c\,"=\frac{c_{i-1}+2c_i+c_{i+1}}{\Delta x}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$c\,"=\frac{c_{i-1}-2c_i+c_{i+1}}{(\Delta x)^2}$$

7) Which of the following expressions is the implicit implementation of the non-steady state diffusion equation? ***1 point***

$$\frac{c_i^{t+\Delta t}-c_i^t}{\Delta t}=\frac{D}{(\Delta x)^2}\left[c_{i-1}^{t+\Delta t}+c_{i+1}^{t+\Delta t}+2c_i^{t+\Delta t}\right]$$

$\frac{c_i^{t+\Delta t}-c_i^t}{\Delta t} = \frac{D}{(\Delta x)^2}\left[c_{i-1}^{t+\Delta t} + c_{i+1}^{t+\Delta t} - 2c_i^{t+\Delta t}\right]$

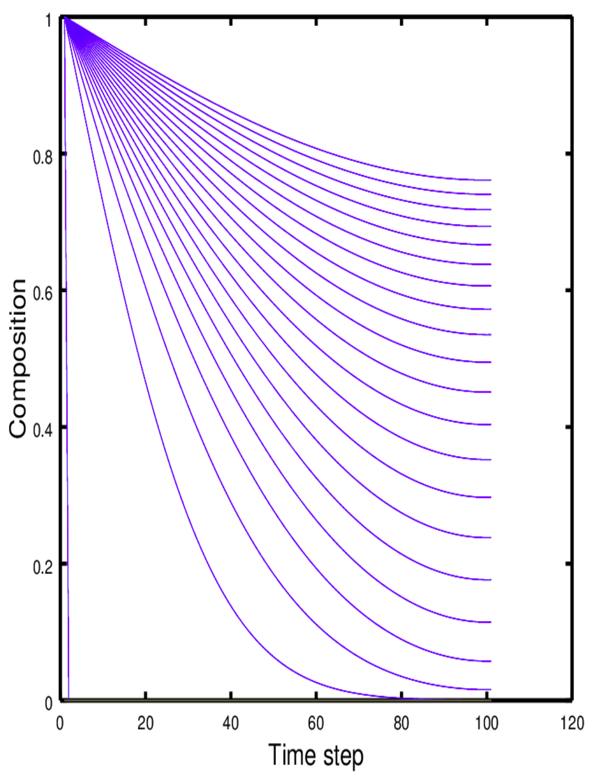
$\frac{c_i^{t+\Delta t}+c_i^t}{\Delta t} = \frac{D}{(\Delta x)^2}\left[c_{i-1}^{t} + c_{i+1}^{t} - 2c_i^{t}\right]$

$\frac{c_i^{t+\Delta t}-c_i^t}{\Delta t} = \frac{D}{(\Delta x)^2}\left[c_{i-1}^{t} + c_{i+1}^{t} + 2c_i^{t}\right]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{c_i^{t+\Delta t}-c_i^t}{\Delta t} = \frac{D}{(\Delta x)^2}\left[c_{i-1}^{t+\Delta t} + c_{i+1}^{t+\Delta t} - 2c_i^{t+\Delta t}\right]$

8) Consider the carburization of steel where the boundary conditions are $c(t) = 1 \quad \text{at x=0 and} \quad (\frac{\partial c}{\partial x})_t = 0 \quad \text{at x=L}$. The gap between the composition profile with increasing time decreases as shown in the figure because ***1 point***



- flux increases.
- flux decreases.
- concentration gradient decreases.
- concentration gradient increases.

No, the answer is incorrect.
Score: 0

Accepted Answers:
concentration gradient decreases.

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