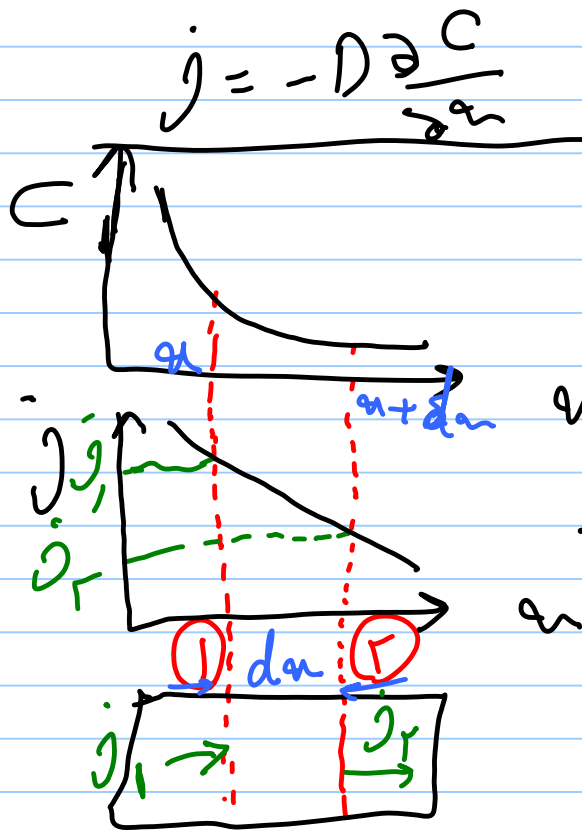


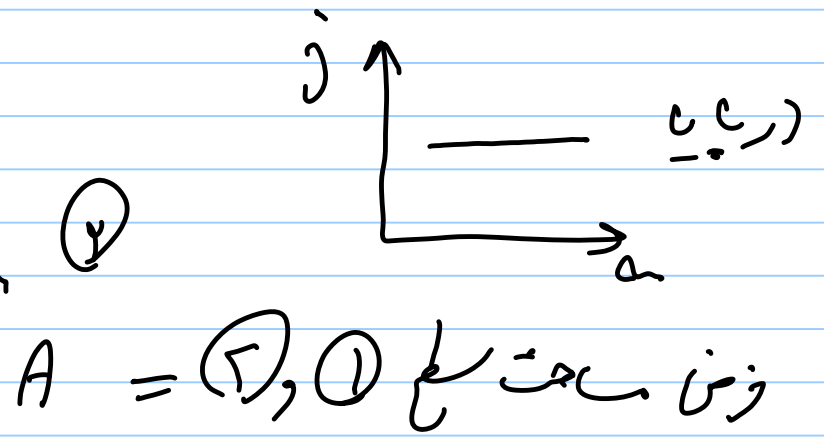
به نام خدا

طلبه هفتاد و نهم از مکتب علم و معرفت

تقوید در حالت ناپایا :



$$j_2 = j_1 + \frac{\partial j}{\partial x} dx \quad (1)$$



رضای ساحت سطح  $A = (1), (2)$

تعداد اتم‌های بین‌شکل B که در یک واحد زمان  $dt$  از صفحه (1) عبور می‌کند.  
 $j_1 A dt$

تعداد اتم‌های بین‌شکل B که در یک واحد زمان  $dt$  از صفحه (2) عبور می‌کند.  
 $j_2 A dt$

$$dc_B = \frac{\text{تغییر تعداد اتم‌های B}}{\text{حجم اتم‌ها}} = \frac{j_1 A dt - j_2 A dt}{A da} \quad j_2 < j_1$$

$$dc_B = \frac{(j_1 - j_2) A dt}{A da} \quad (1)$$

$$j_1 - j_2 = - \frac{\delta j}{\delta n} da$$

$$dc_B = -\frac{\partial j}{\partial n} \frac{dn}{dt} \Rightarrow \frac{dc_B}{dt} = -\frac{\partial j}{\partial n}$$

$$\frac{\partial C_B}{\partial t} = -\frac{\partial j}{\partial n}$$

$$\Rightarrow \frac{\partial C_B}{\partial t} = \frac{\partial}{\partial n} \left( D_B \frac{\partial C_B}{\partial n} \right)$$

قانون دوم فیک

اثر فیک

$$D_B = \text{cte} \Rightarrow \frac{\partial C_B}{\partial t} = D_B \frac{\partial^2 C}{\partial n^2}$$

$$\frac{\partial C_A}{\partial t} = \frac{\partial}{\partial x} \left( \tilde{D} \frac{\partial C_A}{\partial x} \right)$$

$\tilde{D}$  = ضریب نفوذ متغیبه

$$\tilde{D} = C_B D_A + C_A D_B$$

الطردم دارین

$$\frac{\partial C}{\partial t} = \frac{\partial}{\partial x} \left( D \frac{\partial C}{\partial x} \right)$$

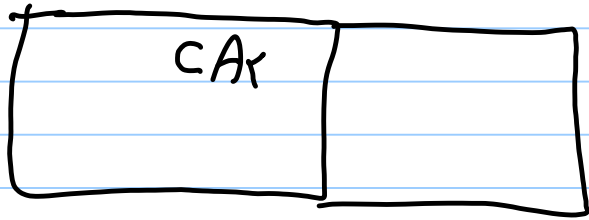
$$0 = \frac{\partial}{\partial x} \left( D \frac{\partial C}{\partial x} \right) \Rightarrow D \frac{\partial C}{\partial x} = A = -j$$

با فرض شرایط اولیه

$$C = C(x, t)$$

$$\frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} \quad \leftarrow D = \text{cte} \text{ فرض مائیں} \leftarrow \text{1- روش گروہ}$$

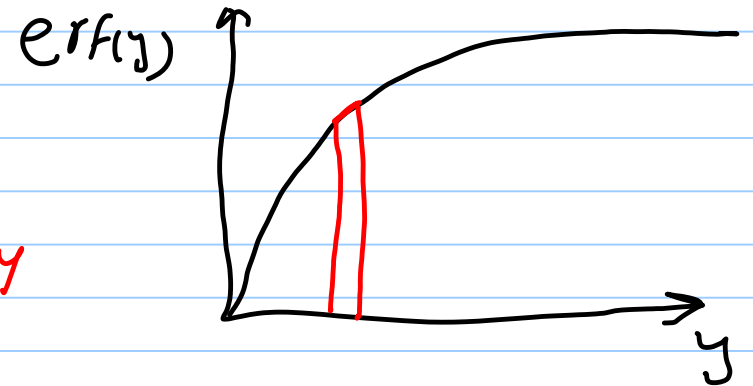
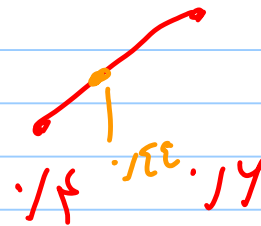
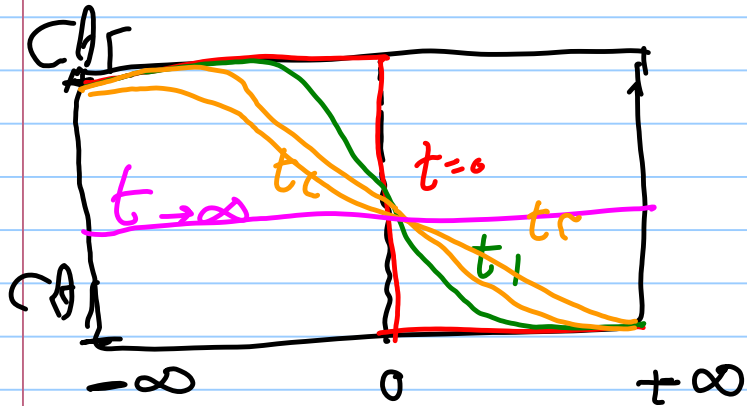
$$\frac{\partial C}{\partial t} = \frac{\partial}{\partial x} \left( \bar{D} \frac{\partial C}{\partial x} \right) \quad D \neq \text{cte} \leftarrow \text{2- روش رافنی مائیں نو}$$



$$D = \text{cte}$$

$$C_A = C_{A1} + \frac{C_{Ar} - C_{A1}}{r} \left[ 1 - \text{erf} \left( \frac{r}{r\sqrt{Dt}} \right) \right]$$

$$\text{erf}(y) = \frac{r}{\sqrt{\pi}} \int_0^y e^{-y^2} dy$$



$y$	0	0.5	1.0	1.5	2.0	2.5	3.0	∞
$\text{erf}(y)$	0	0.5205	0.8427	0.9691	0.9943	0.9993	1	1

$$\text{erf}(1.5) = ? \quad \frac{0.9691 - 0.8427}{1.5 - 1.0} = \frac{\text{erf}(1.5) - 0.8427}{1.5 - 1.0}$$

$$\text{erf}(0) = 0 \quad \text{erf}(\infty) = 1 \quad \text{erf}(-y) = -\text{erf}(y)$$

$$C_A(x, t) = C_{A1} + \frac{C_{Ac} - C_{A1}}{\gamma} \left[ 1 - \operatorname{erf}\left(\frac{x}{\sqrt{Dt}}\right) \right] \quad \text{بموجب شرایط اولیه و مرزی}$$

$$C_A = C_{A1} + \frac{C_{Ac} - C_{A1}}{\gamma} \Rightarrow C_A = \frac{C_{A1} + C_{Ac}}{\gamma} \quad \text{در } x=0, t > 0$$

$$C_A = C_{A1} + \frac{C_{Ac} - C_{A1}}{\gamma} (1 - (-1)) = C_{Ac} \quad \text{در } x < 0, t = 0$$

$$C_A = C_{A1} + \frac{C_{Ac} - C_{A1}}{\gamma} (1 - 1) = C_{A1} \quad \text{در } x > 0, t = 0$$

$$C_A = C_{A1} + \frac{C_{Ac} - C_{A1}}{\gamma} (1 - (-1)) = C_{Ac} \quad \text{در } x = -\infty, t > 0$$



$$CA = CA_1 + \frac{CA_c - CA_1}{c} (1 - 1) = CA_1 \quad a \rightarrow +\infty, t \rightarrow \infty$$

$$CA = CA_1 + \frac{CA_c - CA_1}{c} (1 - 0) = \frac{CA_1 + CA_c}{c} \quad (a \rightarrow \infty, t \rightarrow \infty)$$