ADVANCED MATHEMATICAL METHODS FOR CHEMISTRY

QUIZ 10 - SOLUTIONS

[1] $\frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2}$ Diffusion equation (c)

[2] Solutions are complex exponentials or sines and cosines (b)

[3] $\nabla^2 u = \frac{1}{v^2} \frac{\partial^2 u}{\partial t^2}$ $v = 2$ (a)

[4] Time dependent Schrodinger equation in 3D has 3 spatial coordinates and one time variable. Separation leads to 4 ODEs (d)

[5] 2D circular domain solutions of 2nd order DEs typically involve Bessel Functions (e)

[6] $\frac{\partial c}{\partial t} = D \frac{\partial^2 c}{\partial x^2} \longrightarrow \frac{\partial \tilde{c}}{\partial t} = -Dk^2 \tilde{c}$

PDE in time → Algebraic in k (c)

[7] $J_0(kr/R)$ is involved so J_0 when $r = R$, function equals 0 (c)

[8] If $C(x,0) = 2$, independent of x, no diffusion will take place $\frac{\partial c}{\partial t} = \frac{\partial^2 c}{\partial x^2} = 0 \Rightarrow C(x,t) = 2$ (d)

[9] After separations: $\frac{4y}{Y} \frac{\partial Y}{\partial y} = \text{const}$ (b)

[10] $\frac{1}{\sin\theta} \frac{d}{d\theta} \sin\theta \frac{dS}{d\theta} + \frac{m^2 S}{\sin^2\theta} = \text{const}$

after solving ϕ part (a)