#1 $$\frac{dc}{dt} = D\frac{\partial^2 c}{\partial x^2}$$

$$\frac{dc}{\Delta t} = D\frac{C_{i+1}^n - 2C_i^n + C_{i-1}^n}{\Delta x^2}$$

using V. Neumann

$$\sigma = \frac{D\Delta t}{\Delta x^2} \le \frac{1}{2}$$ for RK4 prescribe $\sigma = \frac{1}{2}$

$$\sigma = \frac{1}{2} = \frac{D\Delta t}{\Delta x^2} \Rightarrow \Delta t = \frac{\Delta x^2}{2D}$$; $\Delta x = \frac{x}{N} = \frac{10}{200} = 0.05$

$$\Delta t = \frac{(0.05)^2}{2(0.1)} = 0.0125s$$

for Crank Nicolson, it was seen through experiments that even at $\Delta t = 1s$ which is only one solution between 2s & 4s it still produced an accurate and stable answer

$$\sigma = \frac{D\Delta t}{\Delta x^2} = \frac{(0.1)(1)}{0.05} = 2$$ so even for $\sigma > \frac{1}{2}$ & $\sigma > 1$

it is still good