case II: identical particles [indistinguishable particles]

$\Psi_{\pm}(r_1, r_2)$

$= \Psi_a(r_1)\, \Psi_b(r_2) + \Psi_a(r_2)\, \Psi_b(r_1)$

Identical particle because we don't know which particle is on which spatial coordinate and so we add on both of them

$\Psi_{11} = A\sigma \left[\dfrac{2}{2} \sin\left(\dfrac{\pi n_1}{2}\right) \sin\left(\dfrac{\pi n_2}{2}\right) + \dfrac{2}{2} \sin\left(\dfrac{\pi n_2}{2}\right) \sin\left(\dfrac{\pi n_1}{2}\right) \right]$

$\Psi_{11}\; 2A\sigma\left[\dfrac{2}{2} \sin\left(\dfrac{\pi n_1}{2}\right) \sin\left(\dfrac{\pi n_2}{2}\right) \right]$

$E_{11} = 2f$

1st excited particle

$\Psi_{12} = A\sigma \left[\dfrac{2}{2} \sin\left(\dfrac{\pi n_1}{2}\right) \sin\left(2\dfrac{\pi n_2}{2}\right) + \dfrac{2}{2} \sin\left(2\dfrac{\pi n_1}{2}\right) \sin\left(\dfrac{\pi n_2}{2}\right) \right]$