1. An electron is confined in a 3D cubic infinite well of side 1nm, compute the energy difference between the ground state and the second excited state.

Answer: Energy eigen value is given as

$E_n = \frac{h^2}{8ma^2}(n_x{}^2 + n_y{}^2 + n_z{}^2)$

Ground state: (1, 1, 1) => $E_{111} = 3\frac{h^2}{8ma^2}$

Second excited state: (1, 2, 2) => $E_{12\,2} = 9\frac{h^2}{8ma^2}$

Energy difference: ΔE= $E_{12\,2} - E_{111} = 6\frac{h^2}{8ma^2}$

For an electron in a cubic box of side 1 nm; **ΔE= 3.61×10^{-19}J**

2. List first six possible distinct eigen states of 3d infinite well.

Answer: The first six energy eigen states ordered in the increasing order of the energy

State No.	(n_x, n_y, n_z)	$n_x^2 + n_y^2 + n_z^2$	Degeneracy
1	(1, 1, 1)	3	1
2	(1, 1, 2) or (2, 1, 1) or (1, 2, 1)	6	3
3	(1, 2, 2) or (2, 2, 1) or (2, 1, 2)	9	3
4	(1, 1, 3) or (3, 1, 1) or (1, 3, 1)	11	3
5	(2, 2, 2)	12	1
6	(1, 2, 3) or (1, 3, 2) or (2, 3, 1) or (2, 1, 3) or (3, 1, 2) or (3, 2, 1)	14	6