# PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

# Two particle System - CSIR NET Physics PYQs

Quantum Mechanics . All PYQs (2015-2025) with answer key

**3 questions . Answer key included**

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**Q1. [June 2023] . 5.0 marks**

Quantum Mechanics > Two particle System

| CSIR NET | 2023 June | 5M |
|---|---|---|

Two distinguishable non-interacting particles, each of mass m are in a one-dimensional infinite square well in the interval $[0, a]$. If $x_1$ and $x_2$ are position operators of the two particles, the expectation value $\langle x_1 x_2 \rangle$ in the state in which one particle is in the ground state and the other one is in the first excited state, is

1. $\frac{1}{2}a^2$
2. $\frac{1}{2}\pi^2 a^2$
3. $\frac{1}{4}a^2$
4. $\frac{1}{4}\pi^2 a^2$

**Q2. [Dec 2025] . 3.5 marks**

Quantum Mechanics > Two particle System

| CSIR NET | 2025 Dec | 3.5M | QM |
|---|---|---|---|

An isolated two-electron quantum state is described by the orbital angular momentum quantum number $l$ and the total spin $S$. An allowed value of $l$ and $S$ is

1. $S = 1, l = 0$
2. $S = 0, l = 1$
3. $S = 1, l = 1$
4. $S = 1, l = 2$

**Q3. [June 2025] . 3.5 marks**

Quantum Mechanics > Two particle System

| CSIR NET | 2025 June | 3.5M | QM |
|---|---|---|---|

A system consists of two non-interacting identical spin-$\frac{1}{2}$ particles. The spatial wave functions for the individual particles are given by $\varphi_1(x)$ and $\varphi_2(x)$. Let $x_1$ and $x_2$ denote the positions of the particles respectively. The total wave function of the system (not necessarily normalized) can be

1. $[\varphi_1(x_1)\varphi_2(x_2) - \varphi_2(x_1)\varphi_1(x_2)][|\uparrow\rangle_1|\downarrow\rangle_2 + |\downarrow\rangle_1|\uparrow\rangle_2]$
2. $[\varphi_1(x_1)\varphi_1(x_2) + \varphi_2(x_1)\varphi_2(x_2)]|\uparrow\rangle_1|\uparrow\rangle_2$
3. $\varphi_1(x_1)\varphi_2(x_2)|\uparrow\rangle_1|\uparrow\rangle_2$
4. $[\varphi_1(x_1)\varphi_2(x_2) - \varphi_2(x_1)\varphi_1(x_2)][|\uparrow\rangle_1|\downarrow\rangle_2 - |\downarrow\rangle_1|\uparrow\rangle_2]$

# Answer Key

3 questions . Subject and topic for quick revision

| Q. No | Subject | Topic | Answer |
|---|---|---|---|
| Q1 | Quantum Mechanics | Two particle System | **3** |
| Q2 | Quantum Mechanics | Two particle System | **3** |
| Q3 | Quantum Mechanics | Two particle System | **1** |

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