

41. A simultaneous measurement of J^2 and J_z is made on a system. A possible outcome of the measurement is

- (A) $j = 3/2, m = 1/3$
- (B) $j = 5/2, m = 0$
- (C) $j = 1, m = -1/2$
- (D) $j = 2, m = -1$

42. For a particle inside a box with rigid walls at $x = 0$ and $x = L$, if the wave function is

$$u(x) = A \cos \frac{\pi x}{2L} + B \sin \frac{3\pi x}{2L} + C \sin \frac{5\pi x}{2L} + D \cos \frac{5\pi x}{2L},$$

the correct boundary condition is

- (A) $A - B = 0$ and $C + D = 0$
- (B) $A + C = 0$ and $B - D = 0$
- (C) $A + D = 0$ and $B + C = 0$
- (D) $A + B = 0$ and $C - D = 0$

43. A particle moves in one dimensional potential $V(x)$ such that $\lim_{x \rightarrow -\infty} V(x) = V_0$ and $\lim_{x \rightarrow \infty} V(x) = 2V_0$ where $V_0 > 0$ and if a bound state with energy E exists then it is expected that

- (A) $E < 0$
- (B) $E < V_0$
- (C) $V_0 < E < 2V_0$
- (D) $E > 2V_0$

44. Consider a particle of mass m making simple harmonic oscillations in one-dimension. If the oscillator is in thermal equilibrium at temperature T with a reservoir, then its average total energy is

- (A) kT
- (B) $2kT$
- (C) $3kT$
- (D) $kT/2$