

2015-PH-14-26

EE24BTECH11034 - K Teja Vardhan

- 1) Let \vec{L} and \vec{p} be the angular and linear momentum operators, respectively, for a particle. The commutator $[L_z, p_y]$ gives
 - a) $-i\hbar p_x$
 - b) 0
 - c) $i\hbar p_x$
 - d) $i\hbar p_y$
- 2) The decay $\mu^+ \rightarrow e^+ + \gamma$ is forbidden, because it violates
 - a) momentum and lepton number conservations
 - b) baryon and lepton number conservations
 - c) angular momentum conservation
 - d) lepton number conservation
- 3) An operator for a spin- $\frac{1}{2}$ particle is given by $\hat{A} = \lambda \vec{\sigma} \cdot \vec{B}$, where $\vec{B} = \frac{B}{\sqrt{2}}\hat{x} + i\frac{B}{\sqrt{2}}\hat{y}$, $\vec{\sigma}$ denotes Pauli matrices and λ is a constant. The eigenvalues of \hat{A} are
 - a) $\pm \lambda B \sqrt{2}$
 - b) $\pm \lambda B$
 - c) 0, λB
 - d) 0, $-\lambda B$
- 4) In an inertial frame S, two events A and B take place at $(ct_A = 0, \vec{r}_A = 0)$ and $(ct_B = 0, \vec{r}_B = 2\hat{y})$, respectively. The times at which these events take place in a frame S' moving with a velocity $0.6cy$ with respect to S are given by
 - a) $ct'_A = 0; ct'_B = -3/2$
 - b) $ct'_A = 0; ct'_B = 0$
 - c) $ct'_A = 0; ct'_B = 3/2$
 - d) $ct'_A = 0; ct'_B = 1/2$
- 5) Given that the magnetic flux through the closed loop PQRSP is Φ . If $\int_P^R \vec{A} \cdot d\vec{l} = \phi_1$ along PQR, the value of $\int_P^R \vec{A} \cdot d\vec{l}$ along PSR is
 - a) $\Phi - \phi_1$
 - b) $\phi_1 - \Phi$
 - c) $-\phi_1$
 - d) ϕ_1
- 6) If $f(x) = e^{-x^2}$ and $g(x) = |x|e^{-x^2}$, then
 - a) f and g are differentiable everywhere
 - b) f is differentiable everywhere but g is not
 - c) g is differentiable everywhere but f is not
 - d) g is discontinuous at $x = 0$
- 7) In Bose-Einstein condensates, the particles

- a) have strong interparticle attraction
 - b) condense in real space
 - c) have overlapping wavefunctions
 - d) have large and positive chemical potential
- 8) Consider a system of N non-interacting spin- $\frac{1}{2}$ particles, each having a magnetic moment μ , is in a magnetic field $\vec{B} = B\hat{z}$. If E is the total energy of the system, the number of accessible microstates Ω is given by
- a) $\Omega = \frac{N!}{\frac{1}{2} \left(N - \frac{E}{\mu B}\right)! \frac{1}{2} \left(N + \frac{E}{\mu B}\right)!}$
 - b) $\Omega = \frac{\left(N - \frac{E}{\mu B}\right)!}{\left(N + \frac{E}{\mu B}\right)!}$
 - c) $\Omega = \frac{1}{2} \left(N - \frac{E}{\mu B}\right)! \frac{1}{2} \left(N + \frac{E}{\mu B}\right)!$
 - d) $\Omega = \frac{N!}{\left(N + \frac{E}{\mu B}\right)!}$
- 9) For a black body radiation in a cavity, photons are created and annihilated freely as a result of emission and absorption by the walls of the cavity. This is because
- a) the chemical potential of the photons is zero
 - b) photons obey Pauli exclusion principle
 - c) photons are spin-1 particles
 - d) the entropy of the photons is very large
- 10) Consider $w = f(z) = u(x, y) + iv(x, y)$ to be an analytic function in a domain D . Which one of the following options is NOT correct?
- a) $u(x, y)$ satisfies Laplace equation in D
 - b) $v(x, y)$ satisfies Laplace equation in D
 - c) $\int_{z_1}^{z_2} f(z) dz$ is dependent on the choice of the contour between z_1 and z_2 in D
 - d) $f(z)$ can be Taylor expanded in D
- 11) The value of $\int_0^3 t^3 \delta(3t - 6) dt$ is
- 12) Which one of the following DOES NOT represent an exclusive OR operation for inputs A and B ?
- a) $(A + \bar{B}) \bar{A} B$
 - b) $\bar{A} B + \bar{B} A$
 - c) $(A + B) (\bar{A} + \bar{B})$
 - d) $(A + B) \bar{A} B$
- 13) Consider a complex function $f(z) = \frac{1}{z(z + \frac{1}{z}) \cos(z\pi)}$. Which one of the following statements is correct?
- a) $f(z)$ has simple poles at $z = 0$ and $z = -\frac{1}{2}$
 - b) $f(z)$ has a second order pole at $z = -\frac{1}{2}$
 - c) $f(z)$ has infinite number of second order poles
 - d) $f(z)$ has all simple poles