

9. If X and Y are Hermitian operators, and if $Z = 3iX + Y$ then Z^\dagger is
- (A) $3iX - Y$
 - (B) $-3iX - Y$
 - (C) $-3iX + Y$
 - (D) $3iX + Y$
10. If $|\psi\rangle$ and $|\phi\rangle$ are normalized to unity and $|\langle\psi|\phi\rangle| = 1$, then
- (A) both $|\psi\rangle$ and $|\phi\rangle$ must be null vectors
 - (B) at most one of the two vectors $|\psi\rangle$ and $|\phi\rangle$ must be null vector
 - (C) $|\psi\rangle = \alpha|\phi\rangle$, where α is a complex number with $|\alpha| = 1$
 - (D) no relation can be given between the two vectors $|\psi\rangle$ and $|\phi\rangle$
11. Which of the following commutators is zero?
- (A) $[xp_y, yp_z]$
 - (B) $[xp_z, yp_y]$
 - (C) $[p_x p_y, xy]$
 - (D) $[p_x^2 + p_y^2, x^2 + y^2]$
12. For a free particle moving in negative x direction with momentum p , the wave function can be written as
- (A) $\exp(ikx + i\omega t)$
 - (B) $\exp(-ikx + i\omega t)$
 - (C) $\exp(-ikx - i\omega t)$
 - (D) $\exp(ikx - i\omega t)$
- where $k = p/\hbar$ and $\omega = E/\hbar$.
13. A reversible adiabatic process is
- (A) isoentropic
 - (B) isoenthalpic
 - (C) isobaric
 - (D) isochoric
14. First-order phase transition is characterized by
- (A) volume continuity
 - (B) entropy discontinuity
 - (C) specific heat continuity
 - (D) Gibbs energy discontinuity