

[Answer Sheet]**Theoretical Question 2*****Motion of an Electric Dipole in a Magnetic Field***

- (1) (a) Equation of motion for the center of mass

Equation of motion for rotation of the dipole around its center of mass

- (b) Conserved quantity
- $\vec{P} =$

Conserved quantity $E =$

- (c) Proof must be given on the answer sheet marked “ Proof for the conserved quantity
- J
- ”

- (2) (a) The critical value of the angular velocity for the dipole to make a full turn is

 $\omega_c =$

- (b) Given
- $\omega_0 > 0$
- , the maximum distance
- d_m
- in the
- x
- direction that the center of mass can reach is
- (answers must include all possible cases)**

 $d_m =$

[Answer Sheet] (continued) *Theoretical Question 2*

Motion of an Electric Dipole in a Magnetic Field

- (c) Tension on the rod (expressed as a function of ω and use the convention that positive value means compression on the rod)

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