*[**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)

$=$