7. BOUNCY BALL

i) Energy is conserved: $\frac{mv^2}{2} + \frac{I\omega^2}{2} = \frac{mv^2}{2} + \frac{I\omega_2^2}{2} \Longrightarrow |\omega_2| = |\omega|$. As the ball receives some angular momentum from the wall (the net force from the wall is not directed through the ball's centre), the angular velocity changes its sign — the rotation flips its direction and $\omega_2 = -\omega$.

ii) The angular momentum is conserved with respect to the contact point, because all the forces are directed through the point. Let $a = R\cos\alpha$ be the distance from the trajectory of the center of mass to the contact point. Then the aforementioned angular momentum conservation reads $I\omega - mav = I\omega_2 + mav$. As $\omega_2 = -\omega$, this gives $\omega = \frac{mav}{I} = \frac{5v\cos\alpha}{2R}$.

iii) At the verge of slipping on a surface, the angle between the surface normal and the resultant of the reaction force and the frtiction force equals $\arctan\mu$. Here this angle is $\frac{\pi}{2} - \alpha$, thence $\mu \geq \cot\alpha$.