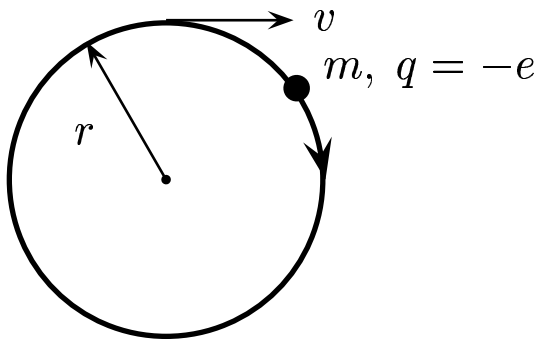
Consider an atom, where an electron is orbiting along a circular orbit with radius r, in a clockwise manner. The orbital speed is v. The electron has a mass m, and a charge "e".



Denote $\vec{\mu}_{\text{orb}}$ to be the corresponding magnetic dipole moment vector. Find $\vec{\mu}_{\text{orb}}$.

A) $\|\vec{\mu}_{\text{orb}}\| = e\,v\,r$ and its direction is $\odot$ (out of).

B) $\|\vec{\mu}_{\text{orb}}\| = \dfrac{e\,v\,r}{2}$ and its direction is $\odot$ (out of).

C) $\|\vec{\mu}_{\text{orb}}\| = e\,v\,r$ and its direction is $\otimes$ (into).

D) $\|\vec{\mu}_{\text{orb}}\| = \dfrac{e\,v\,r}{2}$ and its direction is $\otimes$ (into).

By inspection, there is a counterclockwise current. The loop-magnet identity implies that $\vec{\mu}_{\text{orb}}$ is *out of* the paper.

For a circular orbit, the area is $A = \pi r^2$, or $\|\vec{\mu}_{\text{orb}}\| = I\,A = \left(\dfrac{e\,v}{2\,\pi\,r}\right)\pi\,r^2 = \dfrac{e\,v\,r}{2}$.

Answer **B**.