29. $\Delta x = (\langle x^2\rangle - \langle x\rangle^2)^{1/2}$ $\Delta p = (\langle p^2\rangle - \langle p\rangle^2)^{1/2}$

Recall from Prob. 28:

$\langle x\rangle = \langle p\rangle = 0$ $\langle x^2\rangle = \frac{\hbar}{2m\omega}(2n+1)$ $\langle p^2\rangle = \frac{m\omega\hbar}{2}(2n+1)$

$$\Delta x \Delta p = \sqrt{\frac{\hbar}{2m\omega}(2n+1) - (0)^2}\ \sqrt{\frac{m\omega\hbar}{2}(2n+1) - 0^2}$$

$$\Delta x \Delta p = \sqrt{\frac{\hbar^2}{4}(2n+1)^2} = \frac{\hbar}{2}(2n+1)$$

for $n = 0$

$\Delta x \Delta p = \hbar/2$. *Yes, it satisfies the uncertainty principle.*