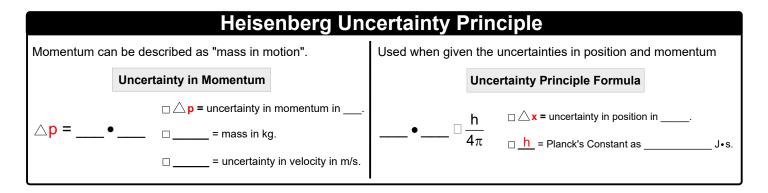
CONCEPT: HEISENBERG UNCERTAINTY PRINCIPLE

Werner Heisenberg theorized the	and	_ of an electron cannot be measured simultaneously.
□ Related to an electron behaving	y both as a wave and a pa	article.
- The of	the electron is related to i	ts wave nature.
- The of	the electron is related to i	ts particle nature.
□ Complementarity: Electrons c	an be seen as particles or	waves, but not both simultaneously.



EXAMPLE: Calculate the uncertainty in velocity of a neutron if the uncertainty in its position is 712 pm. The mass of a neutron is 1.67510×10^{-27} kg.

PRACTICE: To what uncertainty (in m) can the position of a baseball traveling at 51.0 m/s be measured if the uncertainty of its speed is 0.12%? The mass of the baseball is 150 g.

CONCERT. HEISENBERG LINGERTAINTY DRINGIR E
CONCEPT: HEISENBERG UNCERTAINTY PRINCIPLE PRACTICE: An electron with a mass of 9.11 x 10-31 kg has an uncertainty in its position of 630 pm. What is the uncertainty
in its velocity?
PRACTICE: An proton with a mass of 1.67 x 10 ⁻²⁷ kg traveling at 4.7 x 10 ⁵ m/s has an uncertainty in its velocity of 1.77 x
PRACTICE: An proton with a mass of 1.67×10^{-27} kg traveling at 4.7×10^5 m/s has an uncertainty in its velocity of 1.77×10^5 m/s. Determine its uncertainty in position.