

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS  
DEPARTMENT OF PHYSICS  
Term 032

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Physics 212 - Quiz #4  
Chapter 4

Key

Id#:

1) A ball of mass 20 g moves with a speed of 30 m/s. If its speed is measured to an accuracy of 0.1%, what is the minimum uncertainty in its position?

$$h = 1.055 \times 10^{-34} \text{ J} \cdot \text{s}$$

$$\Delta p * \Delta x = \frac{h}{2}$$

$$\Delta p = m \Delta v \Rightarrow m \Delta v * \Delta x = \frac{h}{2}$$

$$\Rightarrow \Delta x = \frac{h}{2 m \Delta v}$$

$$\frac{\Delta v}{v} = 0.001 \Rightarrow \Delta v = 0.001 * v = 0.03 \text{ m/s}$$

$$\Rightarrow \Delta x = \frac{1.055 \times 10^{-34}}{2 * 20 \times 10^{-3} * 3 \times 10^{-2}} = \boxed{8.8 \times 10^{-32} \text{ m}}$$

- Too small to be detected!

2) An atom in an excited state 1.8 eV above the ground state remains in that excited state 2.0  $\mu\text{s}$  before moving to the ground state. What is the minimum uncertainty in its energy?

$$\Delta E * \Delta t = \frac{h}{2}$$

$$\Delta E = \frac{h}{2 \Delta t} = \frac{1.055 \times 10^{-34}}{2 * 2 \times 10^{-6}} = 2.6 \times 10^{-29} \text{ J}$$

$$= \boxed{1.6 \times 10^{-10} \text{ eV}}$$