Q1. complete kinetic energy & velocities of an electron in terms of neutron for which De Broglie wavelength are equal to 1A°.

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$$\lambda = \frac{h}{mv}$$

Given that deBroglie wavelength are equal for both

$$\frac{h}{m_e v_e} = \frac{h}{m_n v_n}$$

$$\frac{m_n}{m_e} = \frac{v_e}{v_n}$$

$$\frac{m_e}{m_n} = \frac{1}{1836.152} \implies \frac{v_e}{v_u} = 1836.152$$

$$\boxed{\therefore v_e = v_n \times 1836.152}$$

$$KE = \frac{1}{2}mv^2$$

$$\boxed{\therefore KE = \frac{1}{2} m v_n^2 [1836.152]^2}$$

Q2. Find wavelength of a neutron having KE = 1eV

→ $\lambda = \frac{h}{mv}$ ∴ $(mv)^2 = \frac{h^2}{\lambda^2}$

$$KE = \frac{h^2}{2m \times \lambda^2}$$

$1 eV = 1.602 \times 10^{-19} J$

$$1.602 \times 10^{-19} J = \frac{(6.63 \times 10^{-34} \, kg \, m^2/s)^2}{2 \times m \times \lambda^2}$$

$$\lambda^2 = \frac{(6.63 \times 10^{-34})^2}{2 \times 1.602 \times 10^{-19}}$$

$$\lambda = 1.2272 \times 10^{-9} m$$

Q3. The radius of a typical atom is 1 A°. To locate the nucleus of an electron within a distance of 5×10^{-12} m using electromagnetic waves, the wavelength must be of this order. Calculate energy & momentum of a photon with wavelength $\lambda = 5 \times 10^{-12}$ m. If $\Delta x = 5 \times 10^{-12}$ m; what is corresponding uncertainity in momemtum?

→ $\lambda = 5\times10^{-12}\,m$ - given

$$E = \frac{hc}{\lambda} = \frac{6.63\times10^{-34}\times3\times10^{8}}{5\times10^{-12}}$$

$$= 3.978\times10^{-4} J$$

$$p = \frac{h}{\lambda} = \frac{6.63\times10^{-34}}{5\times10^{-12}} = 1.33\times10^{-21}\ kg\,m/s$$

uncertainity in momentum

$$\Delta p * \Delta x \geq \frac{h}{4\pi}$$

$$\therefore \Delta p \geq \frac{h}{4\pi\Delta x}$$

$$\boxed{\therefore \Delta p \geq 1.055\times10^{-23}\ kg\,m/s}$$

Q4. Compare wavelength of a cricket b[all] of mass 500 gm flying with a velocity at 500 km/hr with that of an e⁻ having energy 100 eV

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$$100\ eV = \frac{h^2}{2m\lambda_e^2}$$

Q7. In two QUBIT's with wave fun $(0.702|0\rangle + 0.702|1\rangle)$ are entangled then what is resultant wave fun?

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For entangled wave
2nd possible state
i.e. $\Rightarrow 2^2 = 4$

$$\psi = ((0.7072|0\rangle + 0.702|1\rangle)) \times ((0.7072|1\rangle + 0.702|1\rangle))$$

$$\psi = ((0.7072 \times 0.7072)|00\rangle) + (0.7072 \times 0.7072)|01\rangle) + (0.7072 \times 0.7072))|010\rangle) + (0.7072 \times 0.7072))|11\rangle)$$

$$\psi = 2 \times (0.50013184)^2 + (0.50013184)^2$$

$$\psi = 4 \times (0.5013184)^2$$

$$\psi = 1.0005273$$

$$\boxed{\psi \simeq 1}$$

Q5. An electron and a 150 gm baseball are travelling with veloc of 25 8 m/s. If they are measured to an accuracy of 0.025%, calculate & compare uncertainity in position of eac

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$P_e = m_e \times v_e$

$P_b = m_b \times v_b$

$\therefore P_e = 9.1 \times 10^{-31} \times 250$

$\therefore P_e = 2.227 \times 10^{-28}$

uncertainity in momentum $= \frac{0.025 \times 2.}{100}$

$= 5.693 \times 10$

$\therefore \Delta x \, \Delta p \geq \frac{h}{4\pi}$

$\Delta x \geq \frac{h}{4\pi \times 5.693 \times 10^{-32}}$

$\boxed{\therefore \Delta x \geq 9.26 \times 10^{-4} m}$

$\lambda e = \frac{h}{\sqrt{2m100eV}}$

$\lambda e = \frac{6.63 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times 1.602 \times 10^{-19}}}$

$\boxed{\lambda e = 1.2278 A^{0}}$

Wavelength of ball of mass 0.5 Kg

$KEb = 0.5 \times \cancel{b}\ 0.5 \times (138.8889)^2$

$KEb = 4822.5309\ J$

$\lambda b = \frac{6.63 \times 10^{-34}}{\sqrt{2 \times 0.5 \times 4822.5309}} = 9.5471 \times 10^{-26} A^{0}$

$\frac{\lambda e}{\lambda b} = \frac{1.2278}{9.5471} \times 10^{26}$

$\boxed{\lambda e = \lambda b \times 1.28 \times 10^{23} m}$