Quiz #20 (The Hydrogen Atom)

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Quantum Mechanics
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Prob.1(3)

The Schrödinger equation for a hydrogen atom can be separated into following two equations.

$$-\frac{\hbar^2}{2M}\nabla_{\mathbf{R}}^2 S(\mathbf{R}) = E_{CoM} S(\mathbf{R}) \qquad \left[-\frac{\hbar^2}{2\mu}\nabla_{\mathbf{r}}^2 + V(\mathbf{r})\right] U(\mathbf{r}) = E_H U(\mathbf{r})$$

Give the meaning of each equation with explanations for M, R, E_{CoM} and μ, r, E_H.

Prob.2(1)

A positronium is a particle made up of an electron and a positron. A positron is an anti-particle of an electron and has the same mass as the electron but a positive electronic charge. Determine the Bohr radius of the positronium. Give your answer in terms of the Bohr radius of a hydrogen atom.

Prob.3(1)

Determine the Rydberg of the positronium. Give your answer in eV.