

## Question #74878, Chemistry Physical Chemistry / Completed

What is Schrodinger equation for hydrogen atom?

### Answer:

\*The electron in the hydrogen atom sees a spherically symmetric potential, so it is logical to use spherical polar coordinates to develop the Schrodinger equation. The potential energy is simply that of a point charge:

$$U(r) = \frac{-e^2}{4\pi\epsilon_0 r}$$

The expanded form of the Schrodinger equation is shown below. Solving it involves separating the variables into the form

$$\Psi(r, \theta, \phi) = R(r)P(\theta)F(\phi)$$

The starting point is the form of the Schrodinger equation:

$$\frac{-\hbar^2}{2\mu} \frac{1}{r^2 \sin\theta} \left[ \sin\theta \frac{\partial}{\partial r} \left( r^2 \frac{\partial \Psi}{\partial r} \right) + \frac{\partial}{\partial \theta} \left( \sin\theta \frac{\partial \Psi}{\partial \theta} \right) + \frac{1}{\sin\theta} \frac{\partial^2 \Psi}{\partial \phi^2} \right] + U(r)\Psi(r, \theta, \phi) = E \Psi(r, \theta, \phi)$$

\* <http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/hydsch.html>

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