

- ① Some crazy two particle system is described by the Hamiltonian

$$\hat{H} = \hat{H}_A + \hat{H}_B.$$

Proceed as far as you can in writing out the wave functions and energy levels.

The Hamiltonian is the sum of two terms that depend on ~~the~~ independent variables so

$$\Psi_{(A,B)} = \Psi_A \Psi_B$$

$$E_{A,B} = E_{A,n_A} + E_{B,n_B}$$

- ② What mathematically is done during the Born-Oppenheimer approximation?

In all but the K.E. operator for the nuclei; the inter nuclear separation R is set equal to a constant. This allows one to write $\Psi_{\text{mol}} = \Psi_e \Psi_n$. The electronic part ultimately reduces to an effective potential energy felt by the nuclei.

- ③ What physically about the diatomic molecule motivates the Born-Oppenheimer approximation?

The nuclei are much more massive ~~the~~ and move much slower than the electrons. Therefore the electrons adjust instantaneously to the nuclei.